

ROAD TESTS: TESLA MODEL X & NEW AUDI A4

CAR DRIVER

JUNE 2016

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THE POWER ISSUE!

McLAREN

TURBOCHARGED 570S
MEETS THE UNBLOWN
911 GT3 RS

VS. PORSCHE

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562 HP



PLUS

3 MORE TURBO
vs. NATURALLY
ASPIRATED COMPAROS

0-60 IN 3.3 SEC
500 HP

F-150 vs. F-150,

MAZDA 3 vs. VOLKSWAGEN GOLF, AND
OF COURSE, CAMARO vs. MUSTANG

DOES DRIVING MATTER?

DOES A WINDING ROAD INTO THE CLOUDS
OR AN EMPTY FREEWAY ON SUNDAY MORNING
MATTER IF THE CAR YOU'RE IN DOESN'T TAKE
ADVANTAGE OF THE MOMENT?

DOES SAFETY, TECHNOLOGY, BEAUTY
OR EFFICIENCY MATTER IF A CAR DOESN'T FEEL
RIGHT IN YOUR HANDS?

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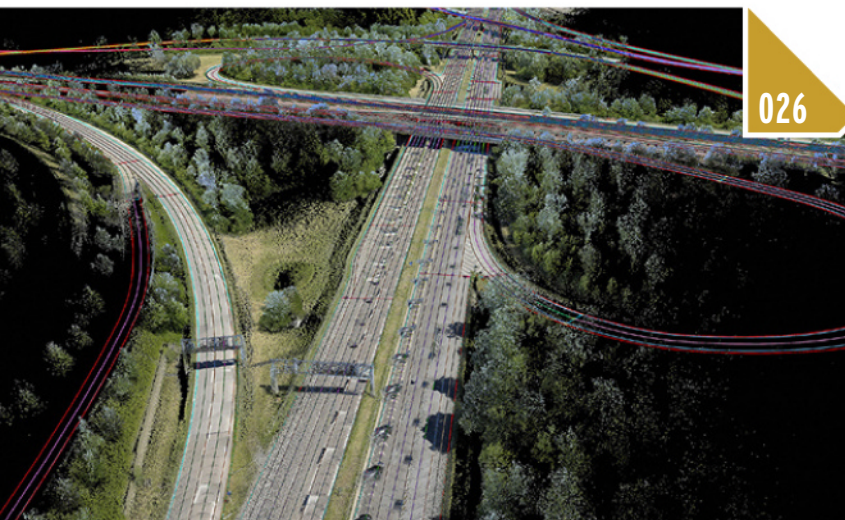
Try to avoid water higher than the bottom of the hubs and proceed slowly. Refer to your owner's manual for detailed information regarding driving through water.

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WHAT I'D DO DIFFERENTLY

Nick Mason.

▼ ON THE WEB

FIRST DRIVE

MERCEDES-AMG GT3 RACE CAR

An unfamiliar track, a beastly race car, and, of course, rain.

CARandDRIVER.com/MercedesAMGGT3

FIRST DRIVE

2016 CHEVROLET CAMARO 2.0T

Four-cylinder power hasn't spoiled it.

CARandDRIVER.com/2016CamaroTurbo

INSTRUMENTED TEST

2016 HONDA CIVIC 2.0L AUTOMATIC

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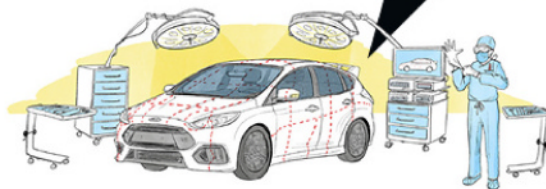


backfires

□ hosted by ED.

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06.2016

Sic your dogs on us at:
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or join the discussion at:
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FOCUSIN'

That Ford Focus RS on the March cover reminds me of the gal at work who had all the plastic surgery; I'm not sure if I like it, but I can't stop looking.

TOM PAGE
WINCHESTER, OREGON

Kudos to Ford for giving the green light to import the 350-hp four-wheel-drive Focus into America ["High-Plain Drifter," March 2016]. Love the styling and the performance, a true pocket rocket. Then I flipped to page 41 and noticed the deal breaker: a photo of the steering wheel and dashboard. Yuck, yuck, yuck. I could never cough up \$40K and be happy sitting behind that cluttered and ugly dashboard every day.

DAVE SPREITZER
NEWPORT BEACH, CALIFORNIA

Finally, the Ford Focus RS hatchback is going to be sold in the United States of America and the rest of the world; in the past years, the previous Ford Focus RS hatchbacks were only sold in Europe. This year at the North American International Auto Show, I got to sit in one that looked exactly like the one on the cover of the March 2016 issue. The Ford Focus RS's interior features very nice, comfortable front sport seats with the optional seat heaters, a six-speed manual transmission, air conditioning, and a touchscreen in-dash computer. This car also has a 350-hp engine with four-wheel drive and very nice RS exterior features that include a large rear wing, dual exhaust pipes, Brembo sport brakes, RS badging, and a small chin spoiler.

MELANIE BARNETT
OSHAWA, ONTARIO

Yes, Barnett, we know—Ed.

DADLANDS

In your luxury-SUV comparison ["Chariots of the Dads," March 2016], you state that the 2017 Audi Q7 "loses the design competition to Volvo." Please. It loses the design competition to a Pontiac Aztek. I'm sure there's some sick bet among Audi designers as to how ugly they can make a great car and have people still buy it. I'll wrap this up now because I want to get down to the Audi dealership to buy one before they make it even uglier.

DAVID SHANNON
REDWOOD CITY, CALIFORNIA

Your excellent review of luxury SUVs in the March issue had the wrong title. It should have been called "Chariots of the Moms." The dads I know are happy to drive sedans, but no self-respecting suburban mother worth her leggings or yoga pants would be caught dead in anything but an SUV, and the bigger the better. Interesting how the winning vehicle, the Q7, is looking more and more like the vehicle no one would be caught dead in: a station wagon.

RICH KOSMERL
LAKE FOREST, ILLINOIS

I have to say, you tested the rest but now you should try the best. I have friends with the BMW X5 and the Land Rover but not the new Volvo or the Audi. I can tell you that my 2015 GMC Yukon Denali is a much better vehicle than the Rover and the X5. Great seating in all seats. Much more room in the back. Great power. Maintenance down the road I know will be less, as this is my third Yukon. Just came back from a trip with 10 days of

in-town driving and 1300 miles of highway driving and averaged 20 mpg.

DAVID ZLOTNICK
SANTA FE, NEW MEXICO

Taos is much better than Santa Fe. Just had to say that—Ed.

Having just finished the SUV comparison, I noticed that there is no mention of whether these cars have spare tires. I know the three-row X5 does not. Having now had two BMWs, I can tell you that run-flats are meaningless if you also bend a rim during your northeastern winter-driving experiences. I suggest a mention of the vehicles having spares, run-flats, or some other variant as it is important, especially in an SUV.

MIKE MARCHIO
HELLERTOWN, PENNSYLVANIA

Audi Q7: No spare available. Run-flat tires and inflator kit on all trims.

BMW X5: Compact spare optional in two-row vehicles (\$150). Run-flat tires on all trims.

Land Rover Range Rover Sport: No spare tire with third row. Compact spare tire standard on two-row trims. Full-size spare included with the \$900 towing package on two-row vehicles.

Volvo XC90: Compact spare tire standard on all trims—Ed.

I have to say I am disappointed that the X5 came in last, having purchased my



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TURNS: 7
BRAKING: 11%

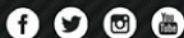


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LENGTH: 1.2 MILES
TURNS: 8
TOP SPEED: 130 MPH



AUTO CLUB
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010

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backfires

second one in three years. I don't blame your writers. Unfortunately, I have to agree with the overall conclusion that BMW has lost its way.

I purchased my first BMW, a five-speed manual 525i, in 2001. It has been followed by eight more BMWs. We currently own a 2011 535i and the aforementioned 2015 X5. The X5 is, noticeably, the least sporting of the BMWs I have owned. I noticed the problem you mentioned with holding it straight on a level road, but I thought it was me. Unfortunately, I think BMW has gone more luxury and less sporting.

I helped a friend in a car hunt that resulted in the purchase of a 2014 Audi A6 Quattro last year. I'm beginning to think there may be an Audi in my future.

MARC DOBIN

JUPITER, FLORIDA

I've been a loyal *Car and Driver* subscriber now for almost 50 years. One reason for this is the frank "tell it like it is" approach to road tests and other automotive subjects. I must admit my faith in this was shaken by the February issue's comparison test of the Chevy Corvette and Ford Mustang Shelby GT350.

I have been looking for a new SUV (my X5 was eight years old) and had pretty much reconciled myself to getting a new X5. I've had X5s for 12 years, liked them, and had no problems. When I read your March comparison test of SUVs where you tested the four I was considering, I thought this was another biased attempt to sell the Audi. There is no way it is that much better than the BMW. Then I drove the new Q7; it is unbelievably great and makes the X5 feel stone-aged. My faith in *Car and Driver* was renewed.

SAMUEL BASS

MOORESVILLE, NORTH CAROLINA

Lipman's reviews of the four "chariots" was a bore to read from the title onward. For the record, I'm not a dad, I didn't want third-row seating, and most importantly, I craved style via something that didn't look, drive, or feel like everything else in its class. The X5 is so 2002, the Audi puts you to sleep from every angle, and the XC90 is great if you want a vehicle made in China. That is

ALL BY MYSELF

In regard to Benjamin Preston's article "Autonomy's Roadkill" [March 2016]: The article talks about lower insurance rates for all and reduced revenue for insurance companies. My question is: Why would I pay insurance for a vehicle I am not in control of? If I purchase a car that takes driving out of the hands of humans and it is involved in an accident, how am I responsible? As long as I maintain it according to manufacturer's specifications so that it is safe and up-to-date with, I assume, software downloads, how is the human at fault? Are we not just passengers at that point? I know that if I have an accident as a driver I'm at fault, not my passengers.

STEPHEN BOURDEAU
KIRKLAND, WASHINGTON

I've always liked the idea of having a self-driving car available for rush-hour traffic and long road trips.

However, as with autonomous commercial airliners, a pilot must be present and ready to take control if necessary. I would expect laws governing our road use to require the



same for personal autos and commercial vehicles, as well as taxicabs.

And watch out, auto-body repair shops.

KEN FARREN
WARRENTON, VIRGINIA

The first autonomous vehicle that kills or maims someone will be the last—at least for a good while. The general public may not be conversant with Asimov's "Three Laws," but they know what they don't like.

MICHAEL REESE
CHICAGO, ILLINOIS

Driverless cars? They'll give a whole new meaning to the term "computer crash."

BARRY CRICKMER
WINCHESTER, VIRGINIA

I'm only running this so that everyone else reading it will feel my pain—Ed.

precisely why I ordered a 2016 Range Rover Sport HSE diesel, which, after a few weeks, I absolutely love. At least he got the exterior styling right at "10."

CDS
TORONTO, ONTARIO

For the record: Quiroga penned the piece, Lipman shot the pictures, and the Volvo is made in Sweden—Ed.

TOYOTATHON

In the 2016 Toyota Prius Two Eco's road test in March, its interior sound level measured 71 dBA for full throttle and 66 dBA for 70-mph cruising. Compare these numbers to the BMW 750i xDrive in the December 2015 issue: 72 dBA for full throttle and 68 dBA for 70-mph cruising.

No matter the car, 66 dBA seems a very good number to me, yet the Prius article remarks about the "high level of road noise." Are the sound levels correct?

TOM QUAN
MOUNTAIN VIEW, CALIFORNIA

Our usual concrete straight was under construction when we tested the Prius. The track we used instead is paved with smoother, quieter asphalt—Ed.

ROYAL SCAM

Congratulations on writing the stupidest article in the history of *Car and Driver* ["No Money, No Problems," March 2016]. It's bad enough it followed the piece on the world's shittiest car (Prius), but the entire premise of conning people out of food and lodging while driving a douchemobile is as dumb as tits on a bull. Cancel my subscription at once! (Actually, don't, but that was cathartic as hell.)

ZBIGNIEW BRZEZINSKI
PHARTKNOCKER, GEORGIA

We've been waiting to hear from you, Mr. Adviser. We always come to Georgia for the pie—Ed.

I find it difficult to believe that the idea to road-trip in a Rolls-Royce, pretending you had no money, was green-lighted and even more surprised that the article was allowed to take up space in your magazine. Is someone at *C/D* working on their Ph.D. thesis in psychology? The article was disturbing and pointless.

TED BARBER
LIBERTYVILLE, ILLINOIS

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NEW PERSPECTIVE ON THE ROAD



BY RAY SAEZ JR.

For an enthusiast, there's something incredibly liberating about aimlessly going for a drive. Therapeutic, actually. The call of the road is irresistible for some of us, like a siren's song drawing us further from home. Sometimes a drive is exactly what one needs to escape reality and discover something unexpected. So I take a vacation day, grab the keys, ignore the map, and suddenly I'm heading for the apex of a bridge overlooking the Atlantic, with beachfront high-rises visible on the horizon and mega-yachts cruising on either side.

"SOMETIMES A DRIVE IS EXACTLY WHAT YOU NEED TO ESCAPE REALITY AND DISCOVER SOMETHING UNEXPECTED."

I may have missed the sunrise, but the ocean vistas never fail to disappoint. Gazing at the tranquil water brings to mind images of untapped potential and power. Right off the bridge, a curvy two-lane road beckons. How could I resist? It's time to tap into the turbocharged power at my command. I'm in the moment, and the harmony between me, machine, and pavement is too good to let slip through my fingers. I move a hand down and slide the shifter into manual mode.

TURN FOR MORE >

012
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. backfires

In Pollack and Sabatini's money-less trip, in measuring how far they got, how much was due to the Rolls-Royce Wraith and how much to the forwardness of two white, Anglo-Saxon, accentless Americans?

FERNANDO LINARES
GUATEMALA CITY, GUATEMALA

SERVICE WITH A SMILE

My dream job was to become a hedge-fund manager, but after reading your long-term review of the 2014 Porsche Cayman in your March issue, my new career goal is to become a Porsche mechanic. To get paid \$540 to perform an oil change and switch out two air filters is an hourly pay rate that many CEOs would be envious of.

HINTZ
ROSEVILLE, MINNESOTA

People dream of becoming hedge-fund managers?—Ed.

In "Farewell My Lovely" in your March issue, your snarky millennial writer, Mr. Pund, made reference to the Saturn homecomings in Spring Hill, Tennessee, as "mediocre economy cars" with "people who felt inexplicably passionate about them."

They were passionate because everything at Saturn was good. The cars were dependable, priced fairly, and the no-haggle sales process built strong loyalty with its largely female customers. You never felt like you got screwed.

When I walked into the Saturn dealer with my wife, Donna got a "Hello, Mrs. Hill" (they always remembered her name) and I got a nod—maybe. His eyes never broke with hers. It was her desires that were important and her fears were discussed and answered honestly. It was she who was the prized customer, and it



built pride, loyalty, and trust with her salesman, the dealership, and the Saturn brand. Closing Saturn ranks as the No. 1 GM screw-up in my lifetime.

Where do you find these writers? Do you pick them up off the floor at Zingerman's, passed out from too much gluten-free food?

JOHN R. HILL
SYLVANIA, OHIO

First off, Pund is no millennial. And from the sound of it, you definitely weren't the one getting screwed—Ed.

I laughed out loud at your Cayman's 40K pit-stop bill. Having owned the same 986 Boxster for 13 years now, I had a similar experience. The dealer wanted \$1500 to change the oil, spark plugs, and accessory belt. "I can buy my own lift with that money!" I thought to myself as I withdrew my service order. And I did.

I learned something new about the car. It is not only a joy to drive, but a joy to work on. Oil changes are dead simple. Coolant? Piece of cake. Spark plugs? What a joke! People pay \$1500 to do this? Special tools my a\$\$\$. I was afraid of this car for years and gladly paid \$400 for an oil change multiple times. Now I do

anything that needs doing, as with any of my daily drivers I've had in those 13 years. It's so well designed from a maintenance standpoint that if it weren't for the near necessity of a lift, [Porsche dealers] could never get away with those rates. Buy the car and love it. Do the maintenance yourself and it's barely more expensive than anything else I've owned. I'll be buying a 911 when this gets tired and will not be afraid. I will never sell my 986, though. Ever.

GRANT SMILEY
CINCINNATI, OHIO

You complain about speed bumps twice in the long-term tests of the Cayman and the BMW M3. If there were one place in the world, one sanctuary from those evil monsters, I'd have thought it would be your parking lot.

Get rid of them or move.

WARREN REDLICH
BOCA RATON, FLORIDA

Are you listening, Oxford Property Management?—Ed.

Because of you, I ordered a new 2014 Cayman S nicely loaded back in January 2013. I took delivery in March of 2013, and

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LETTER OF THE MONTH

I'm a professional comedian (well, I'm an eighth-grade English teacher, but my students think I'm hilarious; just ask me), and I've always believed that the best joke is the unexpected joke. I encountered just such a joke in the Upfront section of the March 2016 issue. I was minding my own business—doing my business—just reading Jared Gall's coverage of the Lexus LC500 when I happened upon the caption, which I don't know if Gall wrote, for the photo of the LC's inside door handles. "The door handles have no bezels." How interesting and beautiful, I thought. "They emerge from the forehead of Worf, son of Mogh..." Bam! I was so surprised by the reference in the (accurate) description that I laughed out loud. So loud, in fact, that my wife yelled, asking what was so funny in the bathroom. Now, I'm a *Star Wars* guy not a *Star Trek* guy, but this joke was hilarious as much for the surprise of it as it was for the reference itself. And whether intentional or not, the caption also includes an Easter egg: another reference to *The Next Generation* with the words "unadorned but nicely styled." I don't know if anyone even noticed the word play, but Lieutenant Worf was played by none other than Michael Dorn! Well played on multiple, if accidental, levels. This is why *Car and Driver* is the car mag I've been reading since I was in eighth grade myself.

MR. H. (CHARLIE HOLLINGSHEAD)
LAWRENCEVILLE, GEORGIA

Do you really think it's a coincidence that the majority of erotic Klingon fan fiction is written by The Alter Man?—Ed.

NEW PERSPECTIVE

ON THE ALL-NEW 2016 CHEVY MALIBU

The car instantly responds. The 2016 Malibu is full of its own power, personality, and charm. The punchy 163 horsepower 1.5 liter engine and 6-speed automatic transmission work in tandem to produce a synchronized thrust. A lighter structure helps not only with acceleration but also handling, as the Malibu eats up the serpentine streets with gusto. Expensive homes and private boat docks fly past, but all I care about is the road ahead as the wind rushes through.

As I exit the esses, a call comes through on the available MyLink infotainment screen,¹ and I answer it without taking my hands off the wheel or my eyes off the road ahead. Everything in the Malibu is geared toward ease of use, making for a seamless and intuitive user experience just like the one you would expect from your favorite pocket-size mobile devices. After all, what is a car if not the ultimate expression of the mobile device?

Lunch at a local restaurant is on the agenda, and even though I'm now deep in unfamiliar territory, the Malibu's technology saves the day,

**"LIFE IS IN THE DETAILS,
AND THE MALIBU CAPTURES
THEM PERFECTLY."**

allowing me to enter a destination via the available Android Auto² compatibility in a flash. The map shows more exciting roads ahead, but first, a quick stop under the causeway bridge to take in the view. Lunch can come later. I'm here for the drive.

Much like the interior, the Malibu's exterior is confidently sculpted, with great lines and highlights at every angle. The wheels are pushed to the corners, enhancing the Malibu's expressive look and setting it apart from other mid-size offerings. A second walk around the car while the waves break behind me leaves plenty to admire, from the sculpted side profile to the thoughtful and subtle Chevrolet bowtie emblems embossed on the front turn signals. Life is in the details, and the Malibu captures them perfectly.

¹MyLink functionality varies by model. Full functionality requires compatible Bluetooth and smartphone, and USB connectivity for some devices.

²Vehicle user interface is a product of Google, and its terms and privacy statements apply. Requires compatible smartphone, and data plan rates apply.



I currently have 21K miles on said vehicle. I just finished reading “Farewell, My Lovely” about your long-term Cayman S. I have one question, if I may: Why did I barely get 15K miles on my rear tires when you estimated 25K? The dealer also said I will need to replace my front tires at 30K and you claim 65K. I do not track my car. Perhaps because here in Florida I am using summer tires? I don’t understand this large discrepancy in tire wear.

HOWARD LITTELL

CLEARWATER, FLORIDA

Many of the long-term Cayman's miles were done on interstate cruises that were easy on the OEM Goodyear Eagle F1 tires (not sure which tires came with your car). If you still think your tire wear is abnormal, you may also want to check your alignment to make sure it's within specifications. See? I can be helpful—Ed.

T AND T

Regarding the Audi TTS review by John Pearley Huffman [March 2016]: “... and the TTS’s larger-diameter disc brakes may stop the universe’s decomposing entropy.” This is the kind of writing that keeps me a subscriber.

BRENT COLLINS

MINNEAPOLIS, MINNESOTA

I was bemused to read John Pearley Huffman’s damned-with-faint-praise review of the Audi TTS, where performance parameters were lauded (4.2-second zero-to-60, 0.98g on the skidpad) but the vehicle ultimately damned because it is derivative of previous generations of the TT. Really? Kick the TTS in the proverbial shins because it has some running gear in common with the Volkswagen Golf R and shares an all-up price with the base Cayman? Perhaps it isn’t a brute-force equivalent of the Corvette, even though it approaches many of the Corvette’s raw numbers in an understated, compact package. It nears Audi R8 performance at less than half the price. Faint praise aside, I’ll take mine and leave cars far behind

whose prestige outweighs their capabilities on the road.

RICK NORTON

DURANGO, COLORADO

BIG FISH

Lexus is building a second-gen flagship coupe called the LC500 that is going to be available in 2017 as an ‘18 [“Lexus Nexus,” March 2016]. The LC500 will have a V-8 that is used in the RC F and the GS F containing 468 horsepower and 391 pound-feet of torque. Its price will be less than half the cost of the Lexus LFA, landing at the high side of \$100,000 for this flagship coupe to invigorate its showrooms and its customer base.

MELANIE BARNETT

OSHAWA, ONTARIO

Melanie, why are you doing this?—Ed.

I enjoyed Clifford Atiyeh’s piece on which cars are bought and which cars are leased [“The Lease They Could Do,” March 2016]. But I am scratching my head to understand the gap between the leasing of Ferraris and Maseratis. According to the illo accompanying the article, 74 percent of Maseratis are leased versus only 4 percent of Ferraris. Both are high-end makes. With the greater price tag, I would have thought Ferraris would be leased in greater numbers. Please shed some light on this conundrum so I can stop scratching.

BART STRINGHAM

BETHESDA, MARYLAND

What you’re seeing is the result of Maserati pushing lease deals—Ed.

IN CONCLUSION

1. Your graphics are always a) gorgeous, b) impossible to understand, c) fun anyhow, d) all of the above.
2. Letters to Backfires should be routinely scanned by police psychiatrists.
3. You guys are really funny.
4. Do people really cancel their subscriptions?

ETHAN REVSIN

COLUMBUS, OHIO

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THE FULL PERSPECTIVE

ENTHUSIASTS CAN FEEL CONFIDENT RECOMMENDING THE 2016 CHEVY MALIBU. HERE, A FEW REASONS:

The 2016 Chevrolet Malibu flaunts an all-new design that packs more than beautiful sheet metal. With multiple engine options offering as much as 250 horsepower on tap from 2.0T-equipped models or as much as an EPA-estimated 47 MPG¹ in the city from Malibu Hybrid (or 37 MPG¹ on the highway with the Malibu shown), there's a model available for every driving personality.

For those of us whose drive is enhanced by technology, Malibu offers a suite of amenities including available built-in 4G LTE connectivity for up to 7 devices.² Available Lane Keep Assist can help ensure that your vehicle stays in its proper lane, and available Rear Cross Traffic Alert will warn you of obstructions when you're backing out of tight quarters (you might not see them in the mirror or with the standard rear-view backup camera).

The Malibu's safety cage uses high-strength and ultra-high-strength steel to help enhance crash performance. The 2016 Chevrolet Malibu comes with a comprehensive air bag sensing system that works in crashes from all directions.

Safety features are no substitute for the driver's responsibility to operate the vehicle in a safe manner. The driver should remain attentive to traffic, surroundings, and road conditions at all times. Read the owner's manual for more important safety information.

The Malibu was born to be driven, and there's no shortage of great places to see.



"THE MALIBU WAS BORN TO BE DRIVEN, AND THERE'S NO SHORTAGE OF GREAT PLACES TO SEE."



**For more information visit
allnewchevymalibu.com**



MALIBU

¹EPA-estimated MPG city/highway 27/37 on 1.5L and 47/46 on Malibu Hybrid. ²Requires a compatible mobile device, active OnStar service, and data plan. 4G LTE service available in select markets. Visit onstar.com for coverage map, details, and system limitations. ³Always use safety belts and child restraints. Children are safer when properly secured in a rear seat in the appropriate child restraint. See the Owner's Manual for more information.

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★ GODSPEED YOU! GREEN EMPEROR

KAISER ROLL — A so-called one-and-a-quarter-ton truck, the original Kaiser Jeep M715 was built for the armed services from 1967 to 1969. It served as an ambulance and a troop carrier.

THIS ISN'T THE FIRST EASTER JEEP ONE-OFF INSPIRED BY THE M715. 2010'S NUKIZER WAS A TWO-DOOR PICKUP CONCEPT.



REVEAL OF THE MONTH

Easter Honey

JEEP'S THROWBACK CREW CHIEF 715 CONCEPT CHANNELS AN ICON. *by Mike Sutton*

MOAB, UTAH, WITH its geologically stunning slick-rock, is a special place for the Jeep faithful and an idyllic playground for the brand's 4x4s. It's also the site of the Easter Jeep Safari, an annual off-roading celebration held around the holiday weekend that draws thousands of four-wheelers to this desert outpost. While the event isn't exclusive to Jeeps, the brand's enthusiasm for it has resulted in the creation of some shut-up-and-take-my-money concepts over the years [see sidebar, page 018]. For this year's shindig, which marked Jeep's 75th anniversary and the Safari's 50th, Jeep shipped out an array of one-offs that ranged from pet-bunny cute to mouth-foamingly crazy. The retro-militarized Crew Chief 715, however, was the one we most wish we could buy.

↓ The Crew Chief is littered with "leet" alphanumeric spellings. Also see the hood sides: "53V3N-FiT33N."

STYLING

Coated in Tactical Green paint, the Crew Chief's design was inspired by the Kaiser M715 military utility rig of the late 1960s, which was based on the civilian-issue Jeep Gladiator pickup. The M715's two-plus-year production run was short, but it still resonates loudly within the Jeep community. The concept's strongest ties to the M715 lineage are its blunt, forward-canted snout and narrow, mesh grille. Styling flourishes are about as critical here as they are to a latrine, so the rugged



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upfront . REVEAL OF THE MONTH



SOME SHORTEN
"NONDIRECTIONAL TREAD"
TIRES TO NDT. WE PREFER
TO CALL THEM BA.

THE AIR-COMPRESSOR FITTING
IN THE DRIVER'S-SIDE BED
MESH SPARKED SOME
HORRENDOUS EARWORMS.



Crew Chief presents as all business: custom five-foot truck bed, minimalist top, and front and rear winches integrated into sturdy steel bumpers.

CHASSIS

The Crew Chief concept may look ready for the frontline, but it's mostly a stretched Wrangler Unlimited underneath. While the truck's narrow, 40-inch-tall, nondirectional-tread military tires look properly old school, they're wrapped around modern 20-inch beadlock wheels. Jeep upgraded the Wrangler's live front and rear axles to beefier Dana 60 units, lifted the body by four inches, and fitted Fox Racing 2.0 remote-reservoir dampers. Keeping with the Kaiser's functional mis-

sion, the Crew Chief features an onboard air compressor for inflating the tires and running air-powered accessories while in the shit.

POWERTRAIN

Though the original Kaiser M715 was powered by Jeep's 133-hp Tornado inline-six, the Crew Chief retains the Wrangler's 3.6-liter Pentastar V-6, which is rated at 285 horsepower and 260 pound-feet of torque from the factory. That's hardly impressive next to some of Jeep's other Moab concepts, but enough to get the Crew Chief wherever it's needed. The concept adds the requisite cold-air intake and freer-flowing exhaust for improved breathing, while a stock five-speed automatic transmission handles shifting duties.

INTERIOR

The Crew Chief's modern Wrangler interior stands in stark contrast to its nostalgic bodywork, and it's more luxurious than any 1960s-era Jeep driver could imagine. Inside, Jeep changed very little for concept duty, save for the canvas inserts in the leather seats. There's also a huge navigational compass bolted to the center stack and four military-style toggle switches atop the dash for accessories, the air compressor, and front and rear locking differentials. Presence on the trail—and the auto-show stand—was the priority for this build, which is fine with us. We still want one.



★ GREATEST EASTER HITS

Jeep has been celebrating the annual Easter Safari by shipping out a truckload of one-offs for years. They reliably fall into a handful of categories: lightweight Wrangler, super-amped Wrangler, retro, military, retro military, and retro pickup. These are a few of our favorites:

TRAILCAT (2016)

This two-seat Wrangler stuffed with a 707-hp Hellcat V-8 and a six-speed manual checked Jeep's crazy box this year. Designers stretched the wheelbase to make the engine fit, but the extra 12 inches can't hurt its stability, either.



CHIEF (2015)

The Chief paired the Wrangler Unlimited's chassis with

a stylized body reminiscent of the Cherokee Chief introduced in the 1970s. Vivid Ocean Blue paint and floral-patterned upholstery lent a surfer-friendly beach vibe.

MIGHTY FC (2012)

A throwback to the Forward Control model of the 1950s and '60s, the Mighty FC packed portal axles, which use geared hubs to place the axle above the wheel centerline and raise ground clearance. Tires that were 40 inches tall also helped it climb over just about anything.



BLUE CRUSH (2011)

Another concept for the nutty column, Blue Crush was a Wrangler Unlimited



powered by a 540-hp Mopar 426-cubic-inch V-8. A Fox Racing suspension let its 39-inch-tall tires move through 16 inches of wheel travel.



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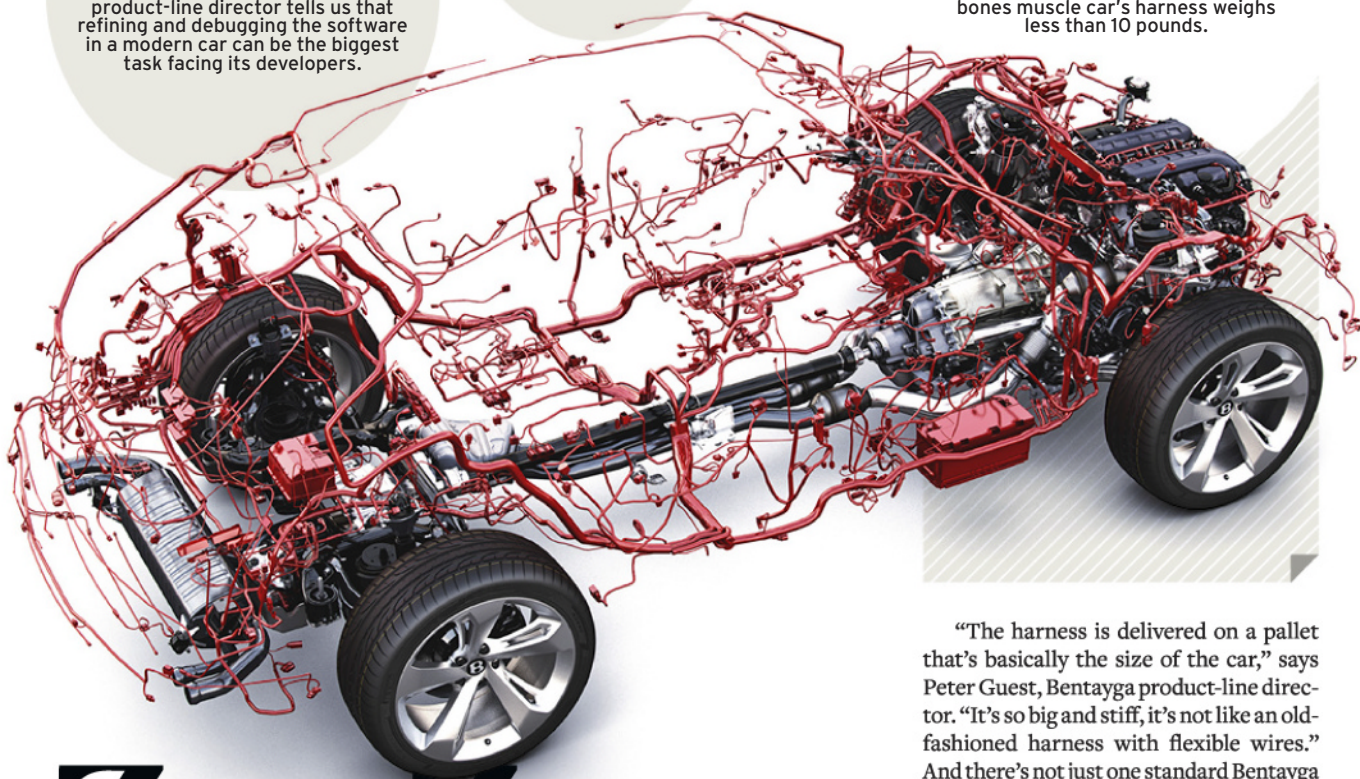
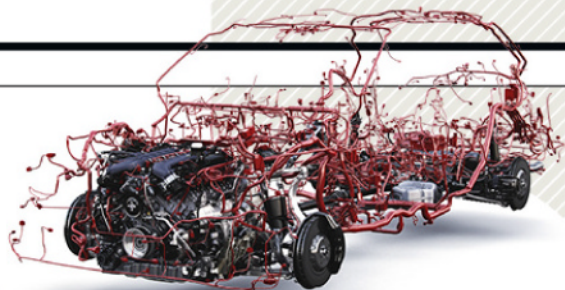
Lines of code in a Bentayga, the vast majority of which are written in proprietary computer languages. The Bentayga's product-line director tells us that refining and debugging the software in a modern car can be the biggest task facing its developers.

90

Number of control modules, or computers, communicating across the Bentayga's local area network.

110

Approximate weight, in pounds, of the wiring in a Bentayga. For comparison, Painless Performance, a company that builds wiring harnesses for restorations, tells us that a bare-bones muscle car's harness weighs less than 10 pounds.



Zap Zone

IT TAKES A LOT OF WIRING TO KEEP A MODERN VEHICLE MOVING. WITNESS THE HARNESS IN THE BENTLEY BENTAYGA. *by John Pearley Huffman*

ALMOST AS MUCH AS FUEL, electronic signals are the lifeblood of a modern vehicle. And the Bentley Bentayga is a poster child for just how complex today's electrical systems can be. If it doesn't have the most-elaborate wiring in the civilian ground-bound vehicular world, it's close. The Bentayga offers four long-range radar systems, up to 12 short-range ultrasonic parking sensors, six camera systems, dozens of lighting elements, a 48-volt roll-control suspension system, a champagne fridge, an 18-speaker stereo, a watch winder, and seats that can warm, cool, and massage occupants. And all of it is designed to withstand heat, cold, dust, moisture, and electromagnetic interference. Presented on this page is what might look like an aggressive case of rosacea but is actually the Bentley's complete wiring harness.

"The harness is delivered on a pallet that's basically the size of the car," says Peter Guest, Bentayga product-line director. "It's so big and stiff, it's not like an old-fashioned harness with flexible wires." And there's not just one standard Bentayga wiring harness. Each individual SUV gets a harness specifically built for it depending on its options load. In Bentley's language, that means the harnesses are "bespoke." But you're probably not going to hear a salesman incorporate that into the pitch.

Of course, the wires in modern vehicles don't just illuminate lights or lower the windows; they also move volumes of information regarding powertrain performance,

vehicle stability, cabin temperature, and so on. "It's seven different networks, all working at different speeds," explains Stuart White, module leader for the Bentayga's electrical system. "And they all have different primary uses. But they're all integrated together. The idea with the information is that it's shared across everything. We don't have one sensor for one function; each sensor feeds information into several different functions."

In geek-speak, this type of network is called a digital multiplex bus system, and it's the standard in virtually all cars today. It cuts down on the need for wire and relays by allowing signals for multiple systems to travel the same wires. Because as huge and complicated as the Bentayga's electrical system is, it's actually much simpler and lighter than it could be.

THE ALL-NEW **PRIUS**

CUT THROUGH EXPECTATIONS

Dramatic meets aerodynamic in the all-new 2016 Prius. Its sleek design turns heads, but is nearly invisible to wind, with a drag-reducing active grille shutter, a built-in spoiler, lowered hood and more, creating a quieter cabin, more stable drive and an air-cheating .24 drag coefficient. The result is mpg that doesn't just defy expectations, it shatters them.



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. **upfront** . AMICUS CURIAE

Pop Tort

RALPH NADER'S MUSEUM TRIES TO MAKE TORT LAW SEEM FUN. WE TRY TO MAKE HIS MUSEUM SEEM DANGEROUS. *by Jared Gall*

THIS MAGAZINE'S history with Ralph Nader could charitably be described as contentious. The safety crusader was a regular punching bag for our columnists for the better part of our existence. But we're men and women enough to stand here today and admit that there's a chance we got a little carried away, and maybe the guy chalked up some worthwhile accomplishments in his career. Whether the American Museum of Tort Law, recently opened in Nader's birthplace of Winsted, Connecticut, is one of those, well, that remains to be seen.

A legal museum sounds about as exciting as a Museum of Unspoken Petty Criticisms. (Marquee display: June 21, 1987, Man takes more than his fair share of space in the office fridge ... again.) But our curiosity was piqued. We found the museum rather interesting; it makes the law approachable and understandable.

If you were to think of tort law as the art of finger-pointing, you wouldn't be far off. The questions at the heart of most tort cases boil down to: Who was at fault? What is an

Staffers at the American Museum of Tort Law raised their eyebrows when they saw us pull up in a Ford Pinto. For a moment, we thought they weren't going to unlock the front door. We borrowed the car from Connie and Bill (last name withheld to protect the lunatic), who currently own seven Pintos. This 1978's original 2.3-liter four-cylinder is gone, replaced by a newer 2.3 from a 1987 Ford Thunderbird Turbo Coupe. When we met Bill at our hotel, he told us he loves everything about the car except its reputation. Not five seconds after we went to check it out, another man walking by in the parking lot saw the car and exclaimed: "Pinto? Better hope you don't get rear-ended!"



MUSEUM EXHIBITS ARE ILLUSTRATED BY POLITICAL AND COMIC-BOOK CARTOONISTS.

acceptable level of risk? Can you ever be safe enough? To that last one, the answer is "Of course not."

Our eye for danger sharpened, we turned it on the very instrument of its honing. Turns out that unseen dangers lurk even in the Museum of Tort Law.

HAZARD: THEATER CHAIRS

A 10-minute film on the history of tort law plays in a small theater in the museum. But really, what's a theater if not a room full of hazards? There's a reason the word is used to denote an area of military operations. A chair's center of gravity leaves it prone to toppling, and while a wider footprint lessens that concern, a greater splay angle on the chair's legs increases the trip hazard.

SOLUTION: Replace the chairs with yoga mats—antimicrobial, of course. And hang dispensers loaded with those wax-paper toilet-seat covers at either entrance to the room.

HAZARD: CORVAIR

The centerpiece of the museum's collection is a beautifully restored 1963 Chevy Corvair, the driver's side propped up on jack stands, a puddle of transmission fluid expanding beneath it. And since the car is on a pedestal, if you step in that puddle, you don't just slip and fall, you slip and fall off a pedestal.



SOLUTION: Encase the Corvair in a solid block of shatter-resistant acrylic, which will have the added benefit of stopping further leaks from developing.

HAZARD: T-SHIRTS

At the tort museum, they're smart enough not to sell hoodies, stranglers that those are. But any clothing on or about the neck could lead to asphyxiation.

SOLUTION: Partner with the nearby Tattoos by Candace for torso embellishments without the choking hazard.

HAZARD: BUTTONS

T-shirt not dangerous enough for you? Why not affix a button! It's a sharp item meant for piercing. Best case, what it pierces is wholly up to the user, but in cases where there is loss of control, what this menace pierces is in the hands of fate alone. Scarring, nerve damage, or blindness, just \$3.

SOLUTION: Sell shirt-friendly magnets—packaged Russian-nesting-doll style in a minimum of three boxes emblazoned with labels warning those with pacemakers to carefully place the box on the ground and walk away at the maximum speed possible without affecting heart rate.

HAZARD: COFFEE MUGS

Ceramics break, a fact attested to by the fragments of a tort-museum mug we stepped over in the parking lot.

SOLUTION: Sue the manufacturer to force the adoption of anti-shatter stand-

ards. Sue footwear manufacturers to establish anti-piercing requirements for sole materials. Petition the federal government to adopt legislation requiring all minors be fitted with outriggers to prevent them from falling down and contacting sharp edges with unprotected skin. As a bonus, outriggers would discourage underage sexual congress.

HAZARD: BOOKS

Byrne v. Boadle was an 1863 tort case in England. Byrne was walking past Boadle's flour warehouse when a barrel rolled out of the second floor and struck him on the head. Books are more or less small barrels of knowledge with corners, just waiting to drop. *Prosser, Wade, and Schwartz's Torts: Cases and Materials*, the heaviest book in the shop, weighs some five pounds. That'll break a toe.

SOLUTION: Sue Foundation Press, the publisher of *Torts*, to force the adoption of round books with airbag-equipped covers.

HAZARD: BAGS

Everybody knows that plastic bags are killers. Every year in the U.S., about 25 children choke on them. But the museum's paper bags are

the Chevrolet Chevette to Ford's Pinto: only safe by comparison. Load up the bag with heavy legal tomes, slip a palm through the handle and lift, and immediately your fingers start to tingle from blood loss.

SOLUTION: Sue the bag manufacturer to establish clear handle-width standards and breakaway limits to minimize the risk of wrist overload. And you'd better believe those handles are going to be antimicrobial.



BOY CLEANS VENDING MACHINE WITH GASOLINE, SPLASHES RAT. RAT RUNS TO HEATER, IGNITES. RETURNS TO MACHINE. MACHINE EXPLODES, KILLS BOTH. MUG COMMEMORATES, BREAKS.



FANNING THE FLAMES – The museum sells merchandise printed with a handful of different images. Our favorite is the flaming Pinto. It's hilariously provocative, but we wondered if Ford could sue the museum over it. A copyright lawyer tells us it could try, but it'd probably fail. Since the image doesn't have "Ford" or "Pinto" anywhere in it, it's not a trademark issue. The Pinto design is technically protected under copyright, but fair-use doctrine allows copyrighted material to be reproduced for purposes of commentary, criticism, or parody. Ford might also argue false endorsement, meaning consumers could believe that the use of the Pinto likeness means that the T-shirts are endorsed by or affiliated with Ford, but that'd be a hard sell.

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Safety for Some

ARE ELECTRONIC DRIVER ASSISTS REALLY FOR EVERYONE? OR ONLY FOR THOSE WILLING TO BE UPSOLD? *by Clifford Atiyeh*

CAR COMMERCIALS may have convinced you that every vehicle on the road is a computerized guardian angel, and there's no question that safety technology is advancing. Sensors, cameras, and the safety features they enable are now cheap enough to be made available on a Hyundai Elantra. But much of the safety tech exalted in ads remains rare, only available on uplevel trims or in packages and almost never as standard equipment. Hoping to gauge how

widespread these features have become, we dug through the configuring tools and pricing guides for more than 350 vehicles on sale today to find out how many offer advanced safety technology as optional equipment, expressed below in percentages. While increasing numbers of mainstream models make this hardware available, we're a long way from everyone benefiting from its universal adoption, so keep watching those mirrors.

REAR-SIDE AIRBAGS

17%

Full-length curtain airbags are standard on every car save for the Jeep Wrangler and a few exotic coupes. But rear side thorax airbags are standard on only 46 models, and they're standalone options on certain Audis and Mercedes. The E- and S-class coupes are the only two-door on sale that offer this protection for rear passengers.

BLIND-SPOT MONITORING

59%

Blind-spot monitoring is increasingly paired with rear cross-traffic alert, which scans for vehicles moving perpendicular to the rear of a vehicle backing out of a parking space. Some vehicles, such as Jaguars and Land Rovers, alert the driver to particularly fast-moving vehicles in either lane by rapidly flashing a warning light.

BACKUP CAMERAS

93%

By 2018, backup cameras will be required on every new car. At that point, Lamborghini won't be able to charge \$3900 for the option. Even so, 43 percent of all new cars don't offer one as standard yet.

ADAPTIVE CRUISE CONTROL

50%

Adaptive cruise control is more than a convenience. On many cars, it's a required option for additional safety tech since it relies on the same sensors.

FORWARD-COLLISION ALERT

60%

Forward-collision alert relies on either radar, laser, or cameras to measure following distance and closing speed. It's an increasingly common option on cars below \$40,000.

AUTO BRAKING

45%

Auto braking, which the federal government and 20 automakers have agreed to make standard equipment by 2022, takes forward-collision alert to its logical conclusion. We only included cars that could actually brake by themselves, regardless of how much deceleration their systems allow (some apply the full braking power, while other systems are less aggressive). We didn't count models that merely prime the brakes but don't decelerate the car.

KNEE AIRBAGS

50%

Knee airbags aren't required under federal law, but tougher IIHS tests and years of accident research prove they can reduce knee injuries in frontal collisions. We included cars with either a driver's-side or front-passenger's-side knee airbag. Some cars have both.

LANE-DEPARTURE WARNING

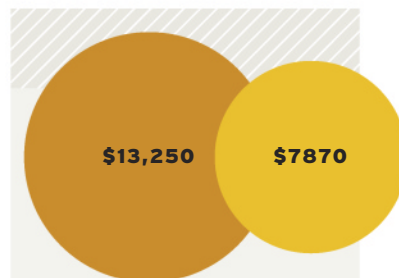
54%

Lane-departure-warning systems use one or more cameras to identify lane markings on the road. They can sound alarms, flash visual alerts, and/or vibrate the steering wheel or seat to alert a driver that his or her vehicle is drifting out of its lane.

LANE-KEEPING ASSIST

28%

As with automatic braking, it's important to separate regular lane-departure warning, or simply alerting the driver to their wandering, from lane keeping, which is an automatic system that applies steering torque or the brakes on the opposite side of the car before the driver leaves their lane. Lane-keeping assists vary widely in effectiveness, but they all include lane-departure warning.



WHEN A BENTLEY IS MORE REASONABLE THAN AN INFINITI

Safety features are often bundled together in option packages, some of which require other packages or trim levels as prerequisites. And just because the content is similar between brands doesn't mean the pricing is, too. To max out the safety gear on an Infiniti QX80 requires four packages, rear-seat entertainment, and 22-inch wheels, for a total of \$13,250. A Bentley Bentayga, on the other hand, offers everything but knee airbags for \$7870. At the far end of the spectrum, Honda and Subaru models tend to offer these features for the lowest prices. The Accord and Civic can be ordered with multiple driver assists on any trim, even the base models, and Subaru offers them on mid-tier models. No other cars offer a comparable level of sophisticated safety features in the mid-\$20,000 range.

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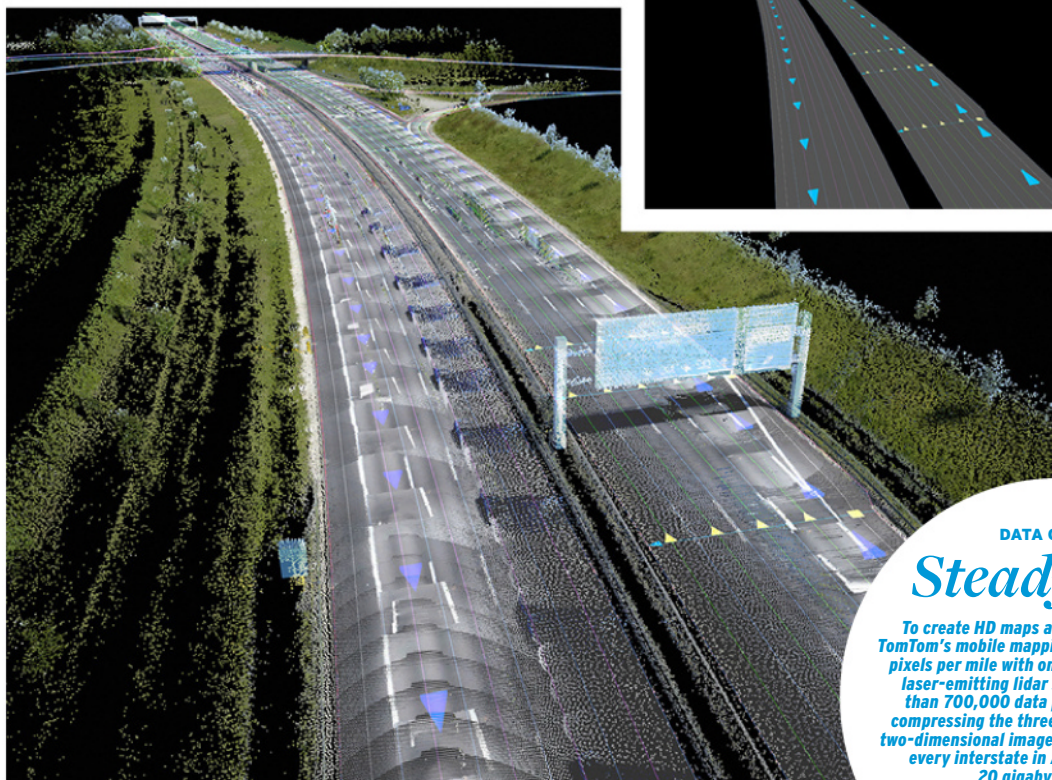
Map Quest

HIGH-DEFINITION MAPS PLOT THE COURSE TO AUTONOMOUS CARS. *by Eric Tingwall*

THE CAMERAS AND RADAR SENSORS that enable today's highly automated cruise-control systems can see only 250 yards ahead in the best conditions. That's barely more than six seconds of lead time at 80 mph, and traffic, weather, and topography often shrink visibility to even shorter distances. For true autonomy, self-driving cars will need a better understanding of the bigger picture.

The coming generation of so-called high-definition maps will supply that picture, along with enough detail for computers to make predictive decisions rather than reactive adjustments. While today's navigation maps represent each road as a single lane, HD maps include multiple lanes with usage rules, curbs, shoulders, road signs, and guardrails. Armed with high-definition maps, the smartest cars will leapfrog slow-moving traffic, negotiate interchanges, move over for merging cars, choose the correct lane for an exit, and

LIKE TOMTOM, HERE CREATES ITS HIGH-DEF MAPS (RIGHT) FROM BILLIONS OF DATA POINTS CAPTURED BY LASER SCANNERS (BELOW).



know where to stop in an emergency—all without driver input.

In charting the course for autonomous cars, mapmakers face a major paradox: The more detailed the map, the more likely it is to be inaccurate. Lanes become shoulders, speed limits change, and construction turns meticulously planned traffic patterns into chaos. That's why Here—a mapping company owned by BMW, Daimler, and the Volkswagen Group—envisioned a future in which autonomous vehicles redraw the maps as they travel the roads.

"We map areas yearly. That's probably not fresh enough to maintain what we need going forward," says John Ristevski, vice president of reality capture and processing at Here. "We need to reflect any changes in the environment in real time." A dynamic layer in Here's HD maps aggregates live data from fixed sensors, government agencies, and other cars on the road to adapt to temporary lane closures, accidents, and traffic jams, along with permanent changes to traffic patterns.

For the mapmakers, the route ahead is marked and clear of obstacles. Here's Ristevski predicts that the most advanced cars will drive entrance-to-exit on our highways without driver intervention or supervision within three to five years.

To Know Where You're Going, You've Got to Know Where You Are

Even the most detailed map is useless if you don't know your location. Consumer-grade GPS can only place a car within a 10-foot circle, so mapmakers have developed methods to pinpoint its exact position on their HD maps, a process known as localization.

TomTom augments its high-def maps with RoadDNA, which compares live data captured by an onboard lidar sensor with images previously recorded by its mapping vans. By identifying patterns in the images and subtle differences between the locations of fixed landmarks, RoadDNA can determine a car's side-to-side position on a road to within six inches. In a typical 138-inch-wide lane, that's precise enough to let the car steer. "A six-inch drift in one direction or the other is something that most of us can hardly perceive, even if we're driving down the road ourselves," says Nhail Cao, TomTom's global product manager. Still, no one is proposing eliminating today's camera-based lane-keeping systems. Well, not yet.

DATA CRUNCH

Steady Gigs

To create HD maps and RoadDNA imagery, TomTom's mobile mapping vans record 22 billion pixels per mile with onboard cameras, while a laser-emitting lidar scanner collects more than 700,000 data points per second. By compressing the three-dimensional data into two-dimensional images, TomTom can condense every interstate in America into roughly 20 gigabytes of data.



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by John Phillips

SIGN LANGUAGE.



Did you know that bicycles are treated as vehicles in all 50 states, which means they have the right to occupy a full travel lane? Me neither. That's why the countryside is plastered in those "SHARE THE ROAD" signs. But it turns out that that particular sign is harder to deconstruct than an airline omelet, and it has the same effectiveness as no sign at all. Bogus, I thought, but it's verifiably true, as demonstrated by 1824 respondents in a 2015 study of motoring perceptions, conducted by M. Nils Peterson and George Hess. On the scale of humorosity, it's about as fun to read as student-loan applications. Evidently, though, if the sign makes onlookers think anything at all, this is what gets thought: Motorists believe it urges bicyclists to move the hell over to the right, and bicyclists

believe it urges drivers to pass way the hell over in the oncoming lane, and I believe it urges civility, such that I shout at bikers: "Hey, looking good, chief. Did you lose some weight?"

The sign's wording is worth considering because most U.S. cities boast bicycle mortality rates about double those in other developed nations. Say Peterson and Hess, the "SHARE THE ROAD" sign has a "high semantic distance," meaning it doesn't portray what it is intended to represent—like presidential candidates—although the folks who devise our nation's signage probably don't fancy themselves as T.S. Eliot anyway. Turns out, a replacement sign that has a superlow semantic distance and is understood by 95 percent of everybody is "BICYCLES MAY USE FULL LANE." Hah! That wasn't hard, was it? Delaware has already dumped its old "SHARE" signs, and the rest of the nation will likely follow.

Of course, obfuscational signage is older than popes on a pension. A sign I see every day reads, "NO PARKING, BUS STOP." Except the one thing that surely parks and stops there is the bus. I'd be more comfortable with something like "PLEASE GLIDE ON THROUGH OR A BUS WILL DRIVE UP YOUR COLON." Or, as you'll see at most airports, "NO STANDING, CARS TOWED AWAY." For starters, "AWAY" is redundant, because

"DEAF CHILD AREA"
*perhaps describes the
area in which the child is
deaf, which would
be around his ear area."*

towing can't lead anywhere but away. More important, if you're "standing," it means you're in the driver's seat, waiting, and if the tow truck at that point carries you *and* your car away, I think that's kidnapping. A clearer sign would be "STANDERS WILL BE HELD FOR RANSOM."

The sign "NO PARKING ON PAVEMENT" seems to encourage us to park on sidewalks or grassy knolls. Whenever I've seen the sign "LANE DROP AHEAD," I've always ached to be carrying a passenger named Lane so I could give him a little sur-

prise. And what shall we make of those "DIP" signs? All roads have dips, often behind the wheel. What I need to know is whether this is a slight swale or a dip similar to an open-pit copper mine.

One roadway sign that slows my pace is "NO PEDESTRIANS, BICYCLES, MOTOR-DRIVEN CYCLES." I have to read through this one carefully to see if I've been named. Wouldn't "STAY OUT" have been simpler? Here's another: "NO NON-MOTORIZED TRAFFIC." My English teacher forbade the use of double negatives, requiring, as they do, the reader to set aside a jot or two for decoding. When I lived in Canada, I had to be told what "ADVANCED GREEN" meant—namely, a flashing green light telling the driver that oncoming traffic has a red light. And "OFFICIAL VEHICLES ONLY" has always offended me, because my registration includes a box for "vehicle type," meaning it's very much officially a kind of vehicle, as confirmed by the state.

Where I grew up, I used to encounter a sign at traffic lights that said, "MOVE FORWARD TO ACTIVIZE SIGNAL." Whenever my mother encountered those signs, she threatened to leap out with a Sharpie to replace "activize" with "activate." Near our old Hogback Road HQ, a sign at the top of a hill warned, "BRAKING MAY BE REQUIRED." I wanted to take my mother's Sharpie and add, "Also steering, thinking, food, rest, breathing, possibly a little sex if we're lucky."

To this day, the sign "NO VEHICLES WITH LUGS" baffles me. Nick Nolte is a big lug. Thugs, maybe? Studs? Here's another enigma: "DEAF CHILD AREA," which perhaps describes the area in which the child is deaf, which would be around his ear area. Here's one that thwarts even medical professionals: "AUTISTIC CHILD." I can't imagine what I'm to do in response. Are autistic kids difficult to see?

In my former home in Pinckney, Michigan, there was a vandalized sign that said, "NO PARKING HERE TO . . . MONDAY." To be safe, I parked there *only* on Mondays.

Finally, there's one sign that affected my outlook. It reads, "END." You see a lot of "END" signs in New York City, and I think it somehow refers to the quality of life you'll be enjoying there if you're a motorist. So I moved to Montana. No "END" signs here. That's because we strive to maintain a high semantic distance. ■

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by Aaron Robinson

THE HOLLYWOOD FREEWAY IS L.A.'S OWN GLITTERING GUTTER.



The death screams of a 1948 Buick speedometer evoked the sound of a snowblower clearing piles of hubcaps. The grand broadsword of a pointer suddenly buried itself at 120 mph while the odometer switched to the mileage pacing of an SR-71 over Smolensk. After removing this big grandfather clock of an instrument, I set out for North Hollywood Speedometer, a shop known for working on “the old stuff.” I figured my transition through downtown Los Angeles would be hastened by my 10 a.m. departure, carefully timed to avoid the morning rush and beat the regular evening commuter rush that starts at 2:30 p.m. and lasts till 8. No such luck. Cars were crawling on the Hollywood Freeway like turtles on Ativan. With a sigh, I settled into my usual slouchy traffic brood: elbow sunk into

the armrest, chin in palm, one finger hooked on the wheel. Having nothing better to do, I studied the shoulder detritus and the tire skids and paint smears on the wall. Over an endless mile, I passed several bumpers, many liberated wheel bolts, three smashed soccer balls, a red broom, shards of shipping pallets, a flattened cellphone, and bottles and cans of every description. In a city cursed daily for its traffic, this 11.8-mile asphalt-and-concrete Cocytus is a river of tears.

The 101, conceived as an express link between the city and its exploding suburbs, wends scenically toward the Cahuenga Pass and the San Fernando Valley beyond. It passes the famously stark-white mausoleum of City Hall, the Hollywood sign, the stacked discs of the Capitol Records building, the Hollywood Bowl, and the turreted former Château Élysée hotel from 1927, now serving as the Church of Scientology Celebrity Centre. It's bathed in the phosphorescent glow of Hollywood and Highland, the epicenter of touristy L.A., where Grauman's Chinese Theatre still gridlocks traffic during film premieres. On its best days, the Hollywood Freeway is a tour of La-La Land in 14 fabulous minutes. On its worst, it is a glutted gutter of garbage.

I'd like to say this wasn't always so, that back when my old Buick was just another used car, traffic ran fast and free. But it's always been this way. Within months of Bob Hope cutting a strip of movie film on April 15, 1954, to open the final segment of the freeway, engineers figured the 168,000 cars using it daily were its max capacity. Hope later said the \$55 million project had built “the biggest parking lot in the world,” but it got worse. In 2014, the daily count past the exit for Universal Studios Hollywood averaged 270,000 cars.

Caltrans spent about \$868,000 in fiscal year 2014–15 for maintenance of the Hollywood, a sum that included sending a “sweeper train” of trucks down the shoulders every six or seven weeks. “Literally, everything you would find in a common household, you find on the freeway,” says Caltrans District 7 spokesman Patrick Chandler. He rattles off a list:

“TVs, computers, monitors, couches, beds, microwaves.” The sweeper train, escorted by a pair of CHPs, includes a pickup truck for the bulky items, a backup truck, and a couple of large trucks with giant vacuums and swirling brushes, one of the latter having a crash cushion on the back in case the impaired or the stupendously inattentive somehow can't avoid it.

The Hollywood's caretakers must also deal with modern “social issues,” including homeless encampments, suicide attempts, and, in recent years, the rampant theft of streetlight wiring and steel railings. Then there's the unexpected, such as the time a truck dumped 840 sheets of drywall in the lanes, or the car carrier that scattered its load of SUVs. A Brink's truck once dropped \$7000 in quarters and dimes, creating the closest thing to an American street paved with gold. In 2010, members of the hip-hop band Imperial Stars, famous for exactly nothing else, parked a truck across three south-bound lanes and started to perform their song “Traffic Jam 101” to a vigorous backbeat of honking. They were arrested moments before being killed.

There's a permanent colony of feral fowl in the shrubs, rumored to have gotten there when a truck overturned years ago.

The Hollywood Freeway chickens even have their own Wiki page. And most Angelenos remember the freeway house from '07, when a resident got fed up with city life and decided to load his house on a trailer and move it out to the desert himself. After an overpass cleaned off the top few inches of the roof, however, the modest mid-century stucco sat blocking a lane for 11 days while roadway wags scribbled on it, “If you lived here, you'd be home by now” and “Easy freeway access.”

I went to pick up the rebuilt speedometer two weeks later, driving the 101 with fresh eyes.

Caltrans is spending \$19.3 million to repair the broken, beaten Hollywood with concrete panels that are cast and cured off-site and then dropped into place. The road is slowly shedding some of its patina. For those of us born in the latter half of the 20th century, freeways just are. They were here when we arrived and they seem to have the permanence of the moon and the mountains. But they all have a story to tell, and it's a story about us. ■



► Even in 1959, the Hollywood Freeway hummed with traffic.



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by Ezra Dyer

THE HAPHAZARD, HALF-HEARTED PURSUIT OF THE RACING LIFE.



Last summer I took an evasive-driving course from the training company BSR, spending two days at Summit Point Motorsports Park in West Virginia ripping around in old Crown Vics and driving backward at high speeds. I also learned some handy tricks in case I run afoul of some bad people after losing a Super Bowl halftime prop bet involving Barry Manilow riding a dirt bike while covering 2 Live Crew's "Hoochie Mama." Here's a tip: The ignition wires on your car should only go to the spark plugs.

Bombing around a road course in cheap, fun cars got me fixated on the idea of attaining a racing license. Which would mean getting a race car. Then I'd be able to do this sort of thing all the time, while improving my driving skills. "So you see,

honey, it's really my professional responsibility to buy a caged Fox-body Mustang. It'll be like a continuing-education credit that is also loud and dangerous and lowers our neighbors' property values."

Feeling the need for organized, officially sanctioned speed, I contacted my regional SCCA honcho to find out how to acquire a competition license. The SCCA has a reputation for being persnickety, but attaining a license seems pretty straightforward. You either go to a driving school and get some type of certificate affirming that your nickname is not Crashy McReckless, or an SCCA instructor vouches for you. It's like joining the International Order of St. Hubertus, but with cars and racetracks instead of green robes and a founder named Count von Sporck. Who was a real guy. And now you've learned something today. Why am I suddenly hungry for mashed potatoes served in a Styrofoam cup?

Anyway, getting the license isn't an undue challenge, but then what? I tell myself that if I had a racing license, I'd get invited to drive some race cars and then I could write stories about those adventures. However, there's an inherent problem with the "writer driving a race car" genre. Those stories always amount to "I went way faster than I thought I could go,



► **Dyer felt the left-rear tire was 1.5 pounds too low.**

but not nearly fast enough to stress the car." Because, what else are you going to say? "Yeah, I think I have some ideas on how to improve the limit behavior of this McLaren F1 car."

No. You're going to make excuses for why you did three laps and the tires are still colder than a narwhal tusk. I once drove an F1 car and the brake cooling ducts were taped off because the brakes were made out of some kind of material scraped from the lint screen of the Large Hadron Collider and had the stopping power of a Pam-coated toboggan unless they were at

race temperature, which is 10 million degrees. I drove that thing as fast as I could, but I gotta say, I left something on the table because of my deep respect for the machine and also I didn't want to wee in my borrowed race suit.

Besides expanded access to cars that are way beyond my ability level, attaining a racing license would also mean that I'd have to work on my attitude. Because if I somehow acquired a reasonable level of track-driving skill, I would not be humble or gracious. I know myself: I'd be a real dick about it. I mean, I kind of already am, and I'm not even good.

If you're really good, you don't even say anything about it. Fellow journalist Alex Lloyd writes about cars, but he's also an accomplished pro racing driver, which is really annoying. At the Dodge Viper ACR launch at Virginia International Raceway, Alex terrified one of the track instructors assigned to ride shotgun on our hot laps. You see, he didn't pull any bluster to the effect of "I qualified at 225 mph for the Indy 500" before going out and driving like someone who qualified at 225 mph for the Indy 500, thus causing the poor instructor to assume that the maniac behind the wheel was a hopelessly deluded prose monkey suffering from a terminal case of inflated self-esteem. Naturally, the instructor's reaction was something along the lines of: "Slow down! We're all gonna die! I hate you!" Even then, Alex was low-key.

Now, if I'd been in the same situation, it would've turned out differently. Because the moment I strapped into the Viper, I would've casually remarked, "This steering wheel reminds me of another car I drove that had a steering wheel—the Indy race car that I raced in the Indy 500 when I was professionally racing race cars." And the instructor would've replied, "I already know that, because your helmet says 'PRO RACING DRIVER' and so does that tattoo on your neck and you already gave me an autograph, which I did not request." And I'd reply, "What?" because I wasn't listening to any of that, on account of I was pondering corner balance or downforce parabolas or whatever it is that race drivers ponder.

It's all a lot to think about, isn't it? That's why I'm still thinking about it instead of following through. Plus, I like having excuses. If you see me out there and I'm not the fastest or the cleanest or the least covered in flop sweat, so what? It's not like I'm a race driver. ■

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NOT JUST WINGING IT

There's more to the Model X than just the silly Falcon Wing doors. But it will forever be known as the Tesla with the silly doors.

by Tony Quiroga
Photography
by Charlie Magee



WE HALF EXPECT DOG, MARTY, AND ELON to step out as the Falcon Wing doors of the Tesla Model X begin to swing open, activated as they are with two successive pushes on the side of the key fob. The rear doors release with an audible click, and then the electric motors whirl as the doors begin their slow skyward ascent. It's the Model X's big trick, and a dubious tie to the hubris of DeLorean, Bricklin, and Icarus.



**TESLA
MODEL X
P90D**





These aren't mere gullwing doors, though; they're far more complex. Power actuated and lined with capacitive, inductive, and sonar sensors behind the aluminum skin to keep them from delivering an uppercut to your head or garage ceiling, the doors are hinged above the glass to automatically fold away from parked cars and obstacles. They're probably the smartest doors ever fitted to a car. But do you *want* complicated doors? Mostly you just want doors to open easily, quickly, and provide a large-enough portal to let you into the cabin. Fully open, the Falcon Wing door provides a large entry, but it's still easy to smack your head on the tip of the wing.

There's a wait, too. The Falcon Wing doors take five and a half seconds to open—six to close—and occasionally the sensors halt their progress, even when there's nothing in the way. For as smart as these doors are, it turns out that even semisentient doors with echolocation are pretty dumb. And yet, the dumbest part of the Model X is the first thing you will show off.

The rest of the Model X isn't dumb—far from it. Tesla's third act, after the Roadster and the Model S, the Model X is a fully



↑ This man has always dreamed of driving a soap bubble. The Model X's enormous windshield is as close as he's going to get.

electric three-row SUV. Built alongside the Model S in Fremont, California, the X shares much with that hatchback, including significant parts of the chassis and the aluminum structure, plus the electric motors

and the battery pack. Tesla's SUV might look like the unwanted offspring of a Model S and a BMW 5-series GT, but at least the shape doesn't offend the wind. The claimed drag coefficient is a very low 0.24.

We tested an X P90D, which means it gets Tesla's largest battery, a 90-kWh lithium-ion pack that provides a claimed range



→ There's easy access to the second and third rows of seats, once the Falcon Wing doors finally open. Watch your head, though.

of 250 miles. In our short time with the Model X, its onboard computer reported that we used 107 kWh over 246 miles; that's the energy equivalent of 77 MPGe.

Like the Model S, the X won't embarrass itself if it lines up next to a supercar on a drag strip. An electric motor at each axle provides four-wheel drive. Add up the motors' maximum potential and you get a theoretical 762 horsepower, but the arithmetic isn't that simple. Power sent to the wheels is limited by the battery's ability to transmit current, so the real combined output is 463 horsepower for the P90D.

Spending \$10,000 for the Ludicrous Speed option adds software changes and what Tesla calls a "smart" fuse. That special fuse increases the battery's output to 1500 amps (up from 1300), and the available output rises to 532 horsepower. With or without Ludicrous Speed, the full 713 pound-feet of torque is available with every punch of the accelerator below 50 mph. That neck-straining torque certainly gives the sensation of 700 horsepower. Or

of falling off a tall building.

All Tesla Performance models—denoted by the P in front of the 90—have launch control that will impress anyone this side of Colonel Stapp. To activate, select Ludicrous Speed mode, hold the brake pedal to the floor, then quickly flatten the accelerator and release. Do it right and "Launch Control Enabled" comes up on the screen. While maintaining your left foot on the brake, go back to the accelerator with the right and hold it. When you feel the X's motors straining against the brakes, release the brake pedal. The acceleration hits so hard that it causes an involuntary and embarrassing "uhhn," a sound usually reserved for prostate exams.

The 60-mph mark arrives in 3.3 seconds, and the quarter-mile flashes by in 11.8 seconds at 116 mph. Stabbing the right pedal from a roll at 30 mph results in 50 mph in 1.3 seconds. It's nearly instantaneous. The 50-to-70 run takes just 2.1 sec-

TESLA MODEL X P90D

➤ Gasp-worthy acceleration; it's fun to watch it drive itself, but even more fun to drive it yourself.

❌ The Falcon Wing doors are slow, silly, and impractical; the second row doesn't fold.

❏ Tesla's third act combines the performance and efficiency of the first two with the practicality of an SUV and the doors of a DeLorean.

onds. Even without launch control, the Model X rips through the 5-to-60 test in 3.5 seconds. Quick by any measure, but let's pause to consider that the 5594-pound Model X is within 76 pounds of a Chevrolet Tahoe. We tested the Tesla on the same day that we ran the McLaren 570S and the Porsche 911 GT3 RS at the track [see page 046]. Only the Model X's acceleration caused an unintentional moan.

After back-to-back zero-to-120-mph runs, the Tesla's battery heats up and gets stingy with the electrons. Loud cooling fans kick on, and the acceleration tapers off. To extract the best times, we waited through a lengthy cool-down period. Most owners will never run repeatedly to 60 mph or more, so they

can fully expect a 3.3-second rocket ride when they take their unsuspecting neighbors out for a cruise.

Owners can also expect a firm, yet comfortable ride and supportive seats covered in soft leather. The button-free instrument panel is straight out of the Model S, down to the beautiful 17-inch touchscreen that controls nearly all vehicle functions, including the power doors. Because of the X's virtu-

ally silent drivetrain, the rush of wind and the hum of the tires come through louder than in gas-powered cars, but at 70 mph we measured a low 65 decibels of noise. The aluminum structure is a fortress of solitude despite the massive openings necessitated by the rear doors. Only an unbuckled passenger's-side seatbelt slapping against the hard seatback disturbs the silence.

The dazzling companion to the silly rear doors is the expansive windshield that stretches into the roof. A dark tint begins where the windshield normally ends and works to keep the cabin from heating up like a greenhouse. Sun visors flip out of the A-pillars and swing into position. We were skeptical of the windshield's worth until we drove among the skyscrapers in downtown Los Angeles. Suddenly, the tops of buildings came into view. We were left dumbfounded, like slack-jawed tourists endlessly looking upward. Lose the Falcon Wing doors, Elon; the windshield is the Model X's best gimmick.

Tesla has ditched the Model S's power door handles that present and retract in the presence of the key. The Model X doesn't really even have handles. Instead, a flush-mounted chrome spear pops open the doors with a push. Like the rear doors, the power front doors open slowly and cautiously to sniff out potential obstacles. Closing can be done with a push, but it's much cooler to watch the doors close themselves when you hit the lock button on the key. We did notice that the front doors slam through the last few inches of travel. To see if the doors would close on an arm or hand, we positioned a plastic water bottle between the jamb and the door. The Model X showed no mercy and crushed it. We'd advise keeping clear of the closing doors.

Second-row seats have power fore-aft adjustments, but no recline. Unlike every other SUV, the Model X's second row doesn't fold, which means this isn't a side-walk-couch-devouring machine. But also unlike every other SUV, there's a deep trunk up front. The second row does slide forward and tilts with the push of a button to allow access to the two-seat third row. Third-row riders get a good amount of space provided the second row stays forward.

Tesla's Autopilot semi-autonomous drive mode will take control of the steering,



TESLA MODEL X P90D

▼ SPECIFICATIONS

PRICE	
AS TESTED	\$133,700
BASE	\$116,700

VEHICLE TYPE: front- and rear-motor, 4-wheel-drive, 7-passenger, 4-door hatchback
OPTIONS: Ludicrous Speed upgrade, \$10,000; Autopilot Convenience features, \$2500; Ultra High Fidelity Sound package, \$2500; Subzero Weather package, \$1000; Deep Blue metallic paint, \$1000

STANDARD: power windows, seats, and locks; remote locking; cruise control; tilting-and-telescoping steering wheel

AUDIO SYSTEM: satellite radio, 5 USB and Bluetooth-audio inputs, iPhone dock, 17 speakers

MOTORS
 2 asynchronous AC

POWER **F:** 259 hp **R:** 503 hp
TORQUE **F:** 244 lb-ft **R:** 469 lb-ft
NET SYSTEM POWER 532 hp
NET SYSTEM TORQUE 713 lb-ft

BATTERY PACK
 lithium-ion, liquid-cooled
CELL COUNT/CONSTRUCTION ... 7000*/cylindrical
CAPACITY 90.0 kWh
MANUFACTURERS Panasonic/Tesla

DRIVETRAIN
TRANSMISSION 1-speed direct-drive
FINAL-DRIVE RATIO **F:** 9.34:1 **R:** 9.73:1
4-WHEEL-DRIVE SYSTEM full time
CHASSIS
 steel-and-aluminum spaceframe with a rubber-isolated rear subframe
BODY MATERIAL: aluminum stampings

EXTERIOR DIMENSIONS

WHEELBASE 116.7 in
LENGTH 198.3 in
WIDTH 81.5 in
HEIGHT 66.3 in
FRONT TRACK 65.4 in
REAR TRACK 66.9 in
GROUND CLEARANCE 6.2-8.9 in

INTERIOR DIMENSIONS

SAE VOLUME **F:** 60 cu ft
M: 52 cu ft **R:** 28 cu ft
CARGO (THIRD ROW UP/FOLDED) 13/68 cu ft
FRONT TRUNK 7 cu ft

STEERING

rack-and-pinion with variable ratio and variable electric power assist

RATIO 15.2-14.4:1

URNS LOCK-TO-LOCK 2.6

TURNING CIRCLE CURB-TO-CURB 40.7 ft

SUSPENSION

F: ind; 1 diagonal link, 1 control arm, and 1 lateral link per side; air springs; anti-roll bar

R: ind; 1 lateral link, 1 control arm, and a toe-control link per side; air springs; anti-roll bar

BRAKES

F: 14.0 x 1.3-in vented disc

R: 14.4 x 1.1-in vented disc

STABILITY CONTROL traction off, launch control

WHEELS AND TIRES

WHEEL SIZE **F:** 9.0 x 22 in **R:** 10.0 x 22 in

WHEEL CONSTRUCTION forged aluminum

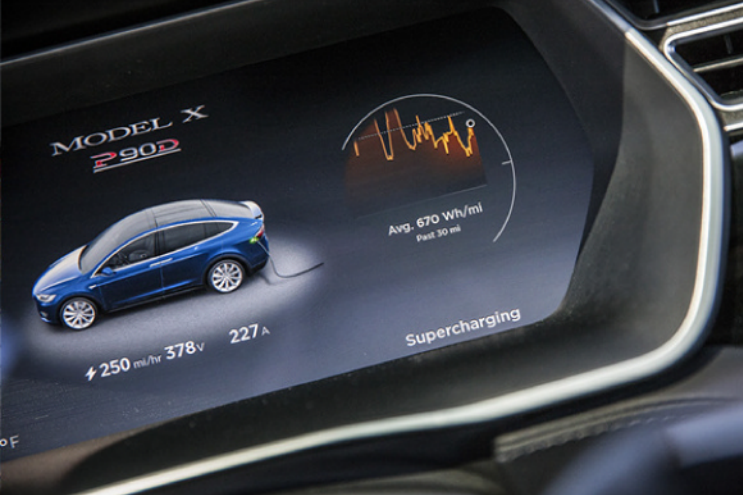
TIRES Goodyear Eagle F1 Asymmetric 3

F: 265/35R-22 102W

R: 285/35R-22 106W

★ NOTABLE HIGHLIGHTS

The Ludicrous Speed option raises the peak current from 1300 to 1500 amps. In addition to the smart fuse, the upgrade replaces the battery pack's steel contactor with Inconel, a nickel alloy, to handle the additional heat.



brakes, and speed. It's fun for a while to sit back and let the computer do the work, but it's a lot more fun to drive the Model X. Whoever does Tesla's chassis tuning is a genius. Like the Model S, the Model X fights below its weight. Its motions are nimble and secure. Body roll is kept to a minimum, and the Goodyear Eagle F1 Asymmetric 3 tires developed specifically for the Model X hang on tightly up to 0.86 g. A thick-rimmed steering wheel—shared with the Model S—provides rich and consistent feedback that would make us break out the

champagne if we found it in a modern BMW. Steering heft can be adjusted from light to heavy, but every setting speaks with the same clear voice.

Braking from 70 mph took 172 feet. In panic stops, the pulsating brake pedal travels nearly to the floor, but the brakes didn't exhibit any fade in our testing. In normal driving, you slow by lifting off the accelerator, which activates the regenerative-braking system that can almost bring the Model X to a complete stop.

Tesla, the company, isn't stopping. Following behind the Model X is the almost-afford-

↑ The Model X's exterior design—a mix of Model S detailing and BMW 5-series GT proportions—is best described as stumpy.

able Model 3. But until the Model 3 arrives late next year, the company remains a boutique selling pricey EVs to rich buyers. The least expensive Model X starts at \$81,200. Our top-spec P90D Ludicrous Speed test car came with a \$133,700 price tag. And yet, the Model X really has no competition. There are no other electric SUVs at the moment. And even against fossil-fuel-fed SUVs, the Tesla's effortless performance and efficiency can't be matched. We should also note that there are no other SUVs with gullwing doors, but now we know there's a good reason for that. ■



CAR AND DRIVER TEST RESULTS

ACCELERATION

ZERO TO	SECONDS
30 MPH	1.4
40 MPH	1.9
50 MPH	2.5
60 MPH	3.3
70 MPH	4.2
80 MPH	5.3
90 MPH	6.7
100 MPH	8.3
110 MPH	10.4
120 MPH	13.0
ROLLING START, 5-60 MPH	3.5
TOP GEAR, 30-50 MPH	1.3
TOP GEAR, 50-70 MPH	2.1
1/4-MILE	11.8 sec @ 116 mph
TOP SPEED (GOV LTD)	130 mph

■ **TEST NOTES:** Launch control requires at least a 90-percent charge, the Max Battery Power setting, and Ludicrous Speed mode switched on. Hold brake with left foot, floor accelerator with right foot, and release. Floor the accelerator again, release the brake, and you're gone.

HANDLING

ROADHOLDING, 300-FT-DIA SKIDPAD	0.86 g†
UNDERSTEER	MINIMAL

■ **TEST NOTES:** The non-defeatable stability control slows the skidpad run. Despite the X's heft, the car feels capable of higher cornering speed. That's because a lot of the mass is in the floor, so there's less body roll than in a normal SUV of the same girth.

BRAKING, 70-TO-ZERO MPH

FIRST STOP	173 ft
SHORTEST STOP	172 ft
LONGEST STOP	177 ft
FADE RATING	NONE

■ **TEST NOTES:** The brakes didn't fade, but the pulsating pedal almost went to the floor during our 70-to-zero-mph stops. Not much brake dive for an SUV. In the standard regen setting, lifting off the accelerator is enough to slow down the Model X in most traffic situations.

WEIGHT

CURB	5594 lb
PER HORSEPOWER	10.5 lb
DISTRIBUTION	F: 47.1% R: 52.9%
TOWING CAPACITY	5000 lb

MILEAGE

EPA CITY/HWY	89/90 MPGe
EPA RANGE	250 mi
C/D OBSERVED	77 MPGe‡

INTERIOR SOUND LEVEL

IDLE	44 dBA
FULL THROTTLE	70 dBA
70-MPH CRUISING	65 dBA

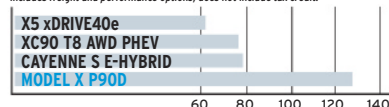
tested by TONY QUIROGA
in California City, California



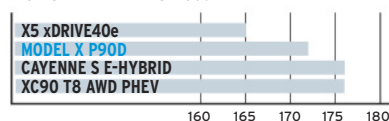
COMPETITORS

BMW X5 xDRIVE40e (2.0-L I-4 + AC MOTOR, 308 HP, 8-SP AUTO)
PORSCHE CAYENNE S E-HYBRID (3.0-L V-6 + AC MOTOR, 416 HP, 8-SP AUTO)
TESLA MODEL X P90D (2 AC MOTORS, 532 HP, 1-SP DIRECT DRIVE)
VOLVO XC90 T8 AWD PHEV (2.0-L I-4 + AC MOTOR, 400 HP, 8-SP AUTO)

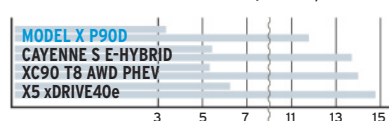
CURRENT BASE PRICE dollars x 1000
Includes freight and performance options; does not include tax credit.



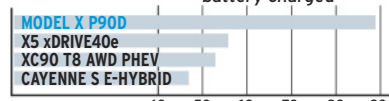
70-0 BRAKING feet



ACCELERATION 0-60 & 1/4-mile, seconds



FUEL ECONOMY EPA combined MPGe, battery charged



Shell
V-Power
NITRO+
Premium Gasoline
The Official Fuel of
CAR AND DRIVER

*Approximated. †Stability-control inhibited. ‡Based on vehicle's trip computer.

THE STORY OF THE ALL-NEW 2016

MALIBU HYBRID

AS TOLD FROM THE DRIVER'S SEAT

The all-new 2016 Chevrolet Malibu Hybrid is taking efficiency to the next level while providing power that you might not expect in a midsize car. We sat down with the GM Global Chief Engineer for Hybrid and Electric Drive Units to hear firsthand about what makes this vehicle such a breakthrough.



Preproduction model shown throughout. Actual production model may vary. Available Spring 2016.





JASON B. DITMAN

GLOBAL CHIEF ENGINEER,
HYBRID AND ELECTRIC DRIVE UNITS

What makes the all-new 2016 Malibu Hybrid so different from other hybrid vehicles?

It's a new hybrid system specifically calibrated for a midsize car. Several things make it different, including the flexibility of a new two-mode hybrid system, the advanced technology of our batteries, and a unique Exhaust Gas Heat Recovery system. These all work together to optimize driving performance *and* efficiency. Malibu Hybrid uses our new two-mode hybrid system to give us greater flexibility in using two electric motors with an efficient new 1.8L gas engine. Like other hybrids, we accelerate from stop using an electric motor and travel at moderate speeds before the gas engine is needed. Our new hybrid system has the flexibility to keep using the electric motors with the gas engine for additional power and performance,

or the motors can operate by themselves for efficiency when cruising at moderate speeds. So you don't have to compromise your drive for efficiency.

Another difference is our battery. The all-new Malibu Hybrid uses advanced battery technology. We have taken a step forward from battery packs found in the first-generation Volt. Our new lithium-ion battery technology, shared with the second-generation Volt, delivers more power in less space and does so more cost effectively (a low cost per kilowatt hour) than anything we've used before. Then there's our new Exhaust Gas Heat Recovery (EGHR) system. The EGHR can help save energy in cold weather by harnessing previously lost energy. The proof is in the mileage. The new Malibu Hybrid is expected to offer a remarkable estimated 48 MPG city.¹

*“You don't have to compromise
your drive for efficiency.”*

Jason B. Ditman

GLOBAL CHIEF ENGINEER, HYBRID AND ELECTRIC DRIVE UNITS

How does the efficiency of the Malibu Hybrid system translate to the driver's experience behind the wheel?

It's a lot of fun to drive. Because the motor is tuned for a midsize car, it offers better performance. The two-mode operation lets us provide an exhilarating driving experience and also saves gas as compared to the 2016 Malibu with a 1.5L engine.² The electric motor has some zippy torque. Unlike a gas engine, which takes time to ramp up, the instant torque of the electric motor allows Malibu Hybrid to accelerate quickly. The two-mode system can employ the gas engine more selectively and more efficiently. This can translate into fewer stops at the pump. In terms of architecture, we've been able to engineer the battery to lie flat and maximize trunk space. It's also a pretty sweet-looking ride.

We understand that GM has developed a new electrification platform that supports both HEVs and plug-in electric vehicles. How did you arrive at this and what are its advantages?

Our real-world experience with Volt has advanced our knowledge of how to use electric motors and gasoline engines together for greater efficiency and greater performance. We've applied all of our learnings to create a single platform. This platform can now support hybrid electric vehicles (like Malibu Hybrid) as well as plug-in electric vehicles (like Volt). The new Malibu Hybrid is the first Chevrolet vehicle, after Volt, to bring this platform to market. And our electrification expertise doesn't stop there. This Fall we're launching the 2017 Bolt EV,³ an all-electric vehicle that is expected to offer an estimated more than 200 miles⁴ of range on a single charge for an affordable price.⁵ Malibu Hybrid, Volt and Bolt EV are going to change the way you think about electrification.

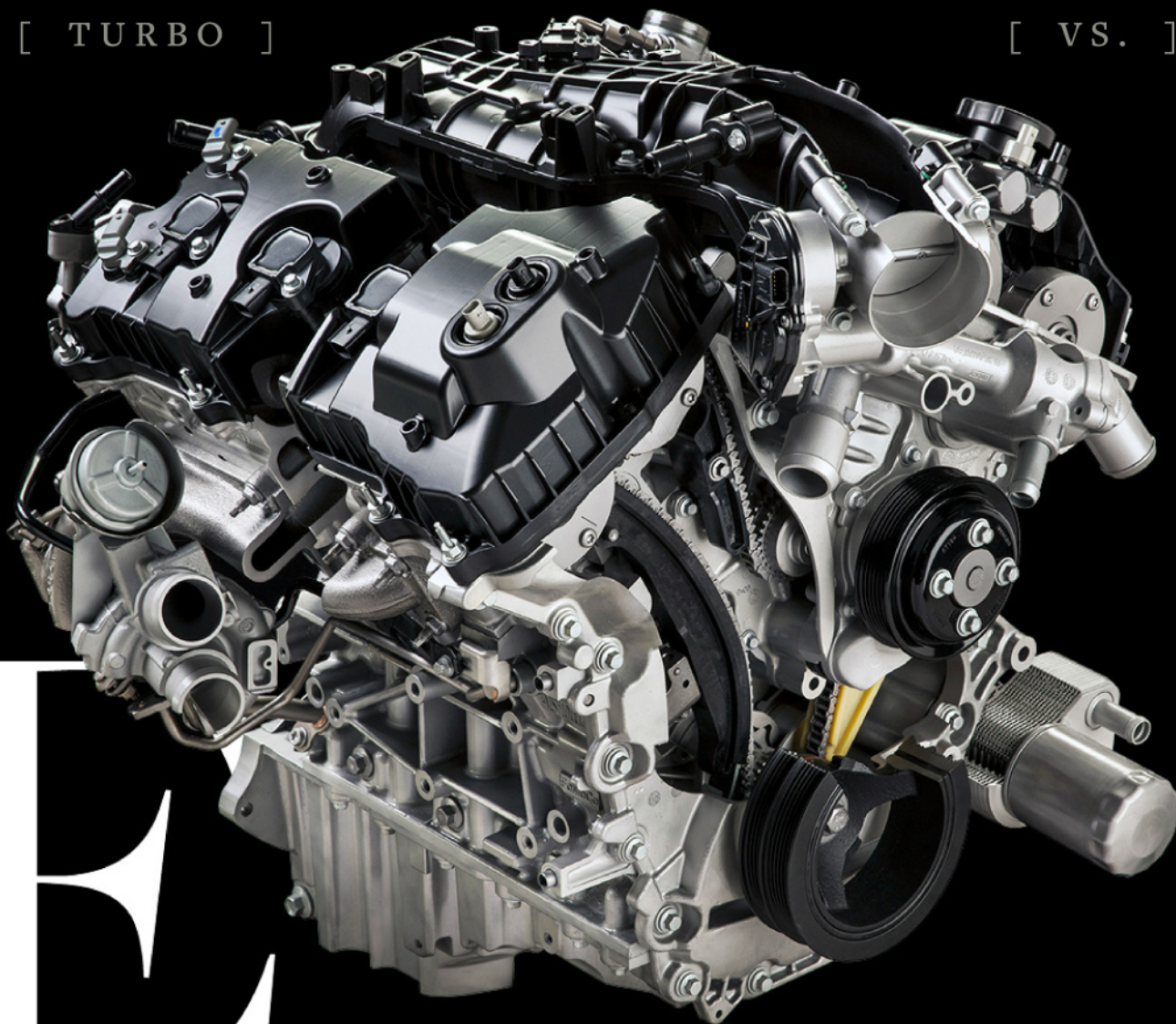


¹ GM-estimated 48 MPG city/45 highway. Official EPA estimates not yet available. Fuel economy estimates based on GM testing. ² Malibu with 1.5L engine EPA-estimated 27 MPG city/37 highway. ³ Available late 2016. ⁴ Based on GM estimates. EPA estimates not yet available. Actual range varies with conditions. ⁵ Priced as low as \$30,000 after federal tax credit. Net price shown includes the full \$7,500 tax credit. \$37,500 MSRP including Destination Freight Charge with tax credit from \$0 up to \$7,500. Tax, title, license and dealer fees extra. Actual savings from the federal government depend on your tax situation. Consult your tax professional for details.

TURBO BLOW

[TURBO]

[VS.]



very new BMW on sale in the United States, save for the electric-drive i3, carries at least one turbocharger. Audi and Mercedes-Benz are nearly as turbo-centric. Even stalwarts of high-revving, naturally aspirated engines, such as Ferrari and Honda, are strapping snails to their engines. And on the home front, Ford has been pushing hard on its EcoBoost turbocharged engines for almost a decade now.

If turbochargers haven't won the war against natural aspiration yet, they certainly appear unstoppable in this, their most recent campaign for domination. Increasingly

stringent fuel-economy and emissions regulations worldwide are driving this switch to forced induction because turbochargers allow carmakers to maintain performance levels while reducing engine displacement and improving EPA fuel economy. Honeywell, a leading turbo supplier, reckons that by the year 2020, 39 percent of all vehicles sold in North America will have turbos, up from 23 percent in 2015.

Turbocharging's day has been long in coming, considering that the concept has been around for more than a century. It's been 54 years since General Motors fitted turbochargers to the Chevy Corvair Monza and the

OR NOT TO BLOW?

[P.045]

[NATURALLY ASPIRATED]



Oldsmobile F-85 Jetfire, and more than 40 since the Porsche 917/30, turbocharged to 1500 horsepower, laid waste to Can-Am competitors.

But turbochargers aren't just for performance cars anymore. They are now the solution of choice for all segments of the market, from city cars to luxury cruisers to—thanks to Ford—full-size pickup trucks. Once you lose V-8-loving truckers to a turbo V-6, the war is all but over and it's just a matter of signing the surrender documents.

On the following pages, you'll find four head-to-head matchups of turbocharged vehicles and their naturally

aspirated competitors, covering the breadth of the light-vehicle market. Beware: These are not conventional comparison tests. We're focusing these stories on the characteristics of the engines and judging the suitability of engine type for each class of vehicle. We also strapped our test gear to several cars to answer the two main questions at the heart of the turbocharged revolution: Do they really save gas, and has turbo lag truly been vanquished from forced-induction engines?

Let the spooling begin.

[P.046] [TURBO VS. NATURALLY ASPIRATED]

McLAREN 570S
TWIN-TURBOCHARGED 3.8-LITER V-8

BREAT

PORSCHE 911 GT3 RS
4.0-LITER FLAT-SIX

Respiration strategies up in the
thin air of the supercar class.

[BY AARON ROBINSON]

[PHOTOGRAPHY BY CHARLIE MAGEE]

THE HEAVY WEIGHTS

THE ONLY NEW 911
MODELS WITHOUT
TURBOS ARE THE
SPECIAL MODELS.
ALL McLARENS ARE
TURBOCHARGED.





YouTube video that made the rounds purports to depict a streetcar ride down San Francisco's Market Street just four days before the calamitous 1906 earthquake that destroyed much of the city. If not filmed then, exactly, the reel was definitely shot in an age when horses still provided much of the motive power in cities.

Where have all the horses gone? To dude ranches and racing stables and country paddocks, where they now serve primarily as objects of sport and leisure, a change that is presumably more fun for them as well as for their owners.

There's no question that an earthquake is coming to our world. The internal-combustion engine, the old nag that has served us so long, is at the precipice, and one of the early tremors indicating the greater seismic disruption to come is the increasing ubiquity of the turbocharger. It's not a new technology, but it is being embraced and refined to an ever-widening degree to allow engine shrinkage without power sacrifice.

In the higher reaches of the performance market, where the horses are already pretty much exercised strictly for pleasure, turbos have invaded. They are here not to offset shrinkage alone, but to also push up power outputs to levels formerly seen only in racing. Take our sherbet-orange McLaren 570S as an example. The 3.8-liter twin-turbo V-8 of the new "entry-level" McLaren, base price of \$187,400, makes 562 horsepower, enough to win Le Mans outright once upon a time. McLaren pulls 666 horsepower from this exact same displacement in the pricier 675LT, and the company's hearty embrace of compressors surely scared Ferrari into adopting turbos for its own V-8s, lest it become the brand of poverty power.

McLAREN 570S

PORSCHE 911 GT3 RS

VEHICLE		
VEHICLE TYPE	mid-engine, rear-wheel-drive, 2-passenger, 2-door coupe	rear-engine, rear-wheel-drive, 2-passenger, 2-door coupe
PRICE AS TESTED	\$218,030	\$204,160
BASE PRICE	\$187,400	\$177,950
ENGINE TYPE	twin-turbocharged and intercooled DOHC 32-valve 3.8-liter V-8, aluminum block and heads, port fuel injection	DOHC 24-valve 4.0-liter flat-6, aluminum block and heads, direct fuel injection
POWER HP @ RPM	562 @ 7400	500 @ 8250
TORQUE LB-FT @ RPM	443 @ 5000	338 @ 6250
TRANSMISSION	7-speed dual-clutch automatic	7-speed dual-clutch automatic
CURB WEIGHT	3272 pounds	3292 pounds

C/D TEST RESULTS

ACCELERATION		
0-30 MPH	1.3 sec	1.6 sec
0-60 MPH	2.7 sec	3.3 sec
0-100 MPH	6.0 sec	7.4 sec
0-160 MPH	16.7 sec	21.8 sec
1/4-MILE @ MPH	10.7 sec @ 133	11.5 sec @ 125
ROLLING START, 5-60 MPH	3.8 sec	3.6 sec
TOP GEAR, 30-50 MPH	2.4 sec	2.5 sec
TOP GEAR, 50-70 MPH	2.7 sec	2.1 sec
TOP SPEED	204 mph (mfr's claim)	193 mph (mfr's claim)
BRAKING, 70-0 MPH	151 feet	145 feet
ROADHOLDING, 300-FT-DIA SKIDPAD	1.07 g	1.09 g
EPA CITY/HWY	16/23 mpg	14/20 mpg
C/D OBSERVED	15 mpg	15 mpg



natural aspiration still relevant or are turbos now necessary to make us hyperventilate? We took to the roads in the cheapest McLaren and one of the most expensive 911s, and also enlisted central California's Buttonwillow Raceway Park to reach an answer. It was a very tough call.

[2] McLAREN 570S

All modern mid-engined supercars live in the long shadow of the Lamborghini Countach, a magically outlandish vehicle that was, to put it bluntly, a bit of a handful. A wedge shape and goofball doors remain as hallmarks of the genre, but supercars as actual cars have improved hugely. The 570S fully upholds McLaren's reputation, begun with the original McLaren F1, of taking the supercar business seriously and building both a voluptuous screaming door-stop and a legitimate handler. But a supercar is not a race car, not when you have an almost-race car to compare it against.

That's not meant as a criticism. There are different ways to get your jollies, and what you have here is basically a Lotus Elise built to go to the moon. In the best British tradition, the steering is hypersensitive, the wheel jumping in your hands as the tires squirm for grip. The chassis reacts vividly to load transfer, sometimes wiggling as you brake, sometimes stepping two feet to the left if it also finds a rut while you're gassing it. The car performs best when buttered with the smoothness of a polished driving technique, but you can be going at 80 percent of the Porsche's pace while feeling like you're doing 150 percent. Which is both hysterically fun and eventually exhausting.

The two turbochargers do the job they were assigned, helping the V-8 make truly jaw-dropping output. Coming in 20 pounds lighter and packing 62 more galloping Clydesdales, the McLaren

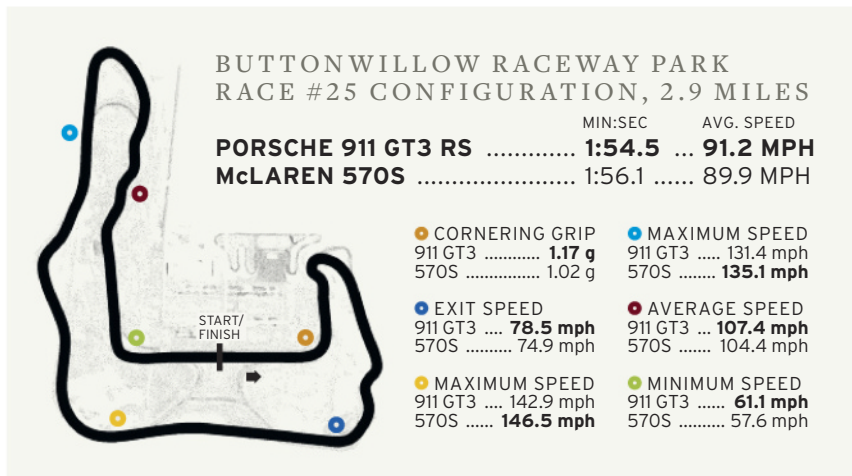
Standing as something of a rock against the encroaching tide is the Porsche 911 GT3 RS. Its 4.0-liter flat-six inhales exactly what a planet with an iron core big enough to give compressive weight to ethereal gas molecules can give it. Which is adequate enough to allow the Porsche to make 500 horsepower. That may not sound like much in these silly days, what with a 1500-hp Bugatti on the auto-show circuit, but it is a lot from a six-pot engine with no induction help.

Not a direct competitor to the mid-engined McLaren, which is an extravagant peacock of a machine with a transparent engine cover and batwing doors slashed with black carbon-fiber lances, the GT3 RS is a peculiar vehicle with a specific task. Carrying a base price of \$177,950, it is optimized for the track and is the closest thing you can get to a Porsche Cup car with a license plate. Or, in this case, a license plate plus carbon-ceramic brakes (\$9210), a front-axle lift system (\$3490), leather upholstery (\$3480), Lava Orange paint (\$3140), and some other plums off the rich Porsche option tree that raise the price to \$204,160.

The McLaren is optioned as well, to \$218,030, including carbon-ceramic brake rotors, a luxury pack with power seats and a 12-speaker Bowers & Wilkins stereo, and the aforementioned sherbet paint, its \$4150 price buying a couple of grated BMWs' worth of metal flake.

At this level of jousting purebreds, is

WITH ITS
TURBO
MUSCLE, THE
570S FELT
QUICKER OFF
THE CORNERS.
IT WASN'T.
THE ALWAYS-
ALERT RS WAS.



handily clobbers the Porsche to the 60-mph mark, completing the job in 2.7 seconds. The turbos aren't slow to wake up, either. Compared with the towering 8800-rpm Porsche, the McLaren gives you more torque in the lobby and lower floors before you start the long elevator ride up the tach. The Brit is a spinner, too, capable of 8100 rpm. But the big shove is over by then, the 443-lb-ft torque peak arriving at 5000 rpm. You could happily upshift in that neighborhood and never feel as if you've left the best part of the engine on the table, there's so much torque waiting for you after the revs drop with the next gear.

The 570S looks fast, it is fast, and it sounds fast, the \$3860 sport exhaust ensuring that everyone hears the lions-fighting-chainsaws startup. But when someone noted that the V-8 isn't so much an engine as a powerplant module, there were knowing nods. In the pursuit of more power, turbos are a Faustian bargain that trades away some of the soul. Plainer, more anodyne music is heard in the McLaren's cockpit, for example, and the throttle response will never be perfect. It is very good, a popgun with a deliciously elongated explosion, but it can't match the Porsche for direct response. The 570S felt quicker off the corners at Buttonwillow, but when we looked at the GPS data, the Porsche actually built speed sooner.

And that is fine. The McLaren doesn't want to be a racer; it's trying to create a 5000-volt arc between your ears using your eyeballs as the electrodes, and it fully succeeds.

[1] PORSCHE 911 GT3 RS

The McLaren's face resembles a smiling shark, while the 911 has the blank stare of an android as it twists your head off. Massive tires stuff the Porsche's wheelwells to bursting, and its mesh screens are moved forward to be nearly flush with the front bumper. Why? Because on a track, crud collects in them otherwise, as it did in the McLaren's deep-set nostrils. The McLaren is theatrical and dramatic, while the Porsche just gets the business done.

The 911 may be clinical, but oh, what an engine! This flattie is one pissed-off pancake. If your day isn't complete without an aural visit to the forests of Spa, then allow us to introduce you to your next car. At 5000 rpm, where you'll be upshifting most days to prevent being arrested, the sound is mellifluous, but the band is just warming up. At 7000, the harmonics are so hot as to be incandescent. A finer flamenco you will never hear in a modern car, especially from this, a lowly half-12.

We said the Porsche builds speed quicker, but that's only true in the first hundred or so feet. Once the McLaren comes up to full bluster, it begins to pull away. The top speed on Buttonwillow's back straight belongs to the 570S, which hit 146.5 mph to the 911's

THE 570S'S POWERFUL LUMP AND ITS LOW-DRAG BODY MEAN IT'S THE QUICKER AND FASTER OF THE TWO.

142.9. And that's off a 3.6-mph deficit through the previous corner as the McLaren pilot cautiously manhandled the nervous car. No doubt, aero is a factor, both at speed and in general cornering superiority as the GT3 RS's big wing bites the wind hard. Above 100 mph, the 911's steering gets noticeably heavier, as if a giant is sitting on the hood. With less horsepower, it beat the McLaren around Buttonwillow by 1.6 seconds.

Going fast is not necessarily joyous; a Southwest Airlines 737 kicks both of these cars to the curb. It all depends on how insulated you are from the environment and the working parts. There's an intimacy with the machinery in the 911 that is slightly blunted in the McLaren because of its turbos and the disconnect, however minimized, they create between inputs and outcomes. You'll win drag races in the McLaren, but is speed everything, or is it the total experience that matters? The GT3 RS makes a convincing case for the latter.

Don't get us wrong; the McLaren 570S is all ate up with dazzling personality. But in this confrontation, the Porsche 911 GT3 RS reminds us of sunsets over Sebring and 935s in the rainy night and why we love engines. When it goes to pasture, as it surely must given that the bulk of the 911 line is now turbocharged, we will mourn an era that has ended.

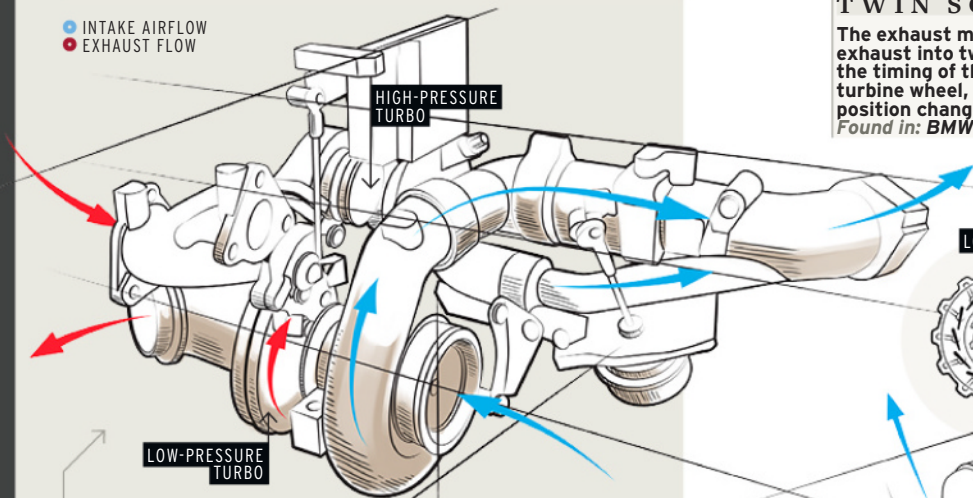


VARIATIONS ON A VANE: MAKING TURBOCHARGERS BETTER, FASTER, STRONGER.

By Eric Tingwall

A TURBOCHARGER IS BASICALLY a hair dryer that adds horsepower. An exhaust-driven turbine wheel spins a centrifugal air compressor to increase the amount of air fed into the cylinders. The additional air, combined with more fuel, boosts power and torque. The following technologies allow for greater output, increased efficiency, or lower lag compared with a single, basic turbocharger:

● INTAKE AIRFLOW
● EXHAUST FLOW



SEQUENTIAL TURBOS

Here, a smaller turbo spools quickly for low-end responsiveness while a larger unit boosts top-end power with higher volumes of exhaust. Sequential setups have fallen out of favor because they require complex controls and bulky packaging, and recent advances have reduced spool-up lag in single- and twin-turbo setups.

Found in: Nissan Titan XD diesel, Audi SQ7 TDI

VARIABLE- GEOMETRY TURBINE

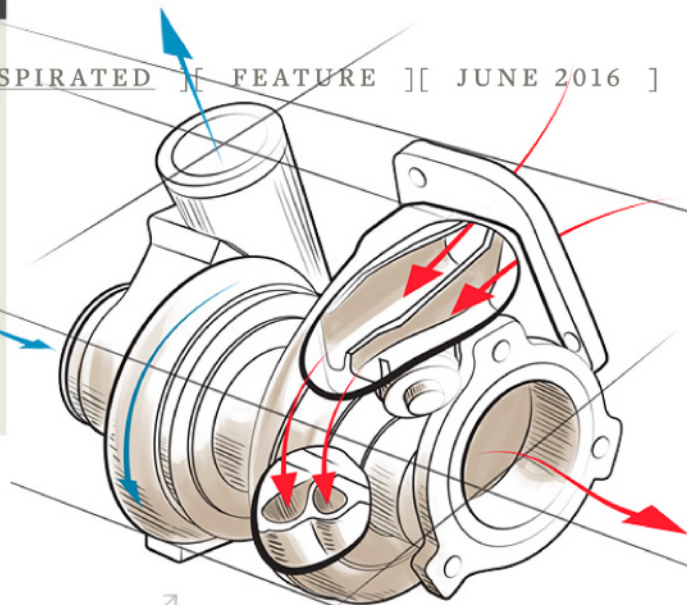
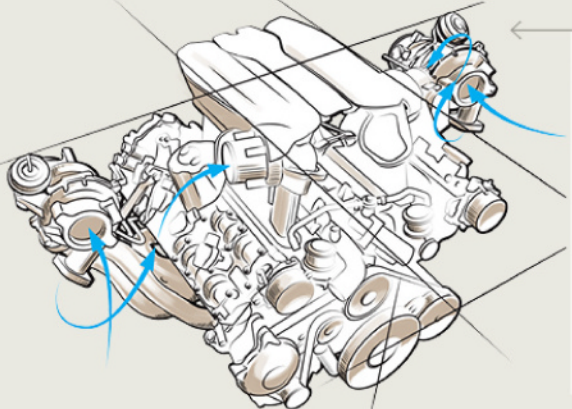
Movable vanes at the turbine inlet change the angle and speed of the exhaust gas before it arrives at the turbine wheel. At low flow rates, the vanes form narrow openings that accelerate the exhaust gas to reduce lag. Electric or pneumatic controls open the vanes to permit greater exhaust volumes to pass through at higher loads.

Found in: Porsche 911 Turbo

TWIN TURBOS

Two equal-sized blowers are each fed by half an engine's cylinders. Using two turbos rather than one leads to smaller turbine and compressor wheels that spool quicker due to their lower inertia.

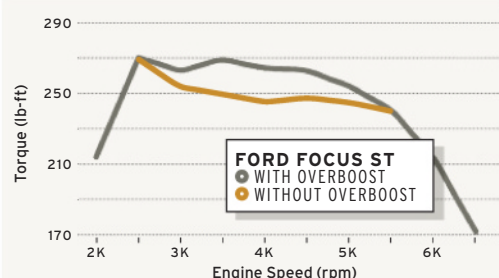
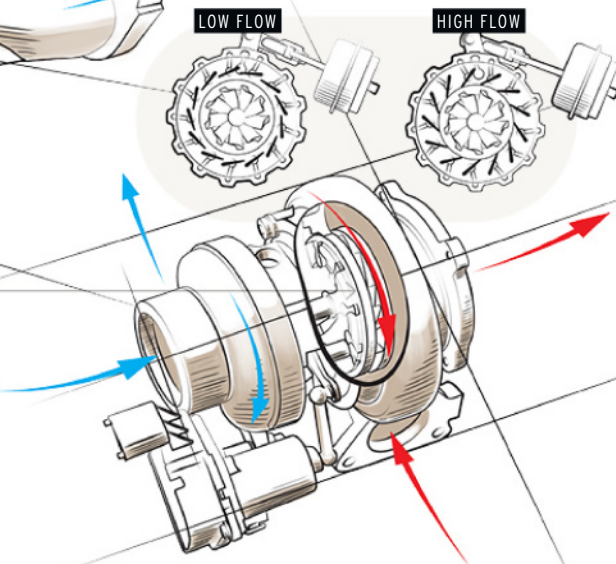
Found in: Ford F-150 EcoBoost



TWIN SCROLL

The exhaust manifold and turbine housing split the exhaust into two segregated streams. This optimizes the timing of the exhaust pulses delivered to the turbine wheel, improving response when the throttle position changes abruptly.

Found in: BMW 328i



OVERBOOST

A temporary increase in boost pressure raises power, torque, and exhaust temperatures. Overboost is typically limited to 10-to-20-second spurts to avoid overheating components and causing catastrophic failure.

Found in: Ford Focus ST

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MR. MUSTARD

Can a small turbo engine compete in this red-meat segment?

[BY DANIEL PUND]
[PHOTOGRAPHY BY JIM FETS]

There are two kinds of people in this world: ketchup people and mustard people. I am a mustard man. Nothing against ketchup, mind you. It's just that it's basically sugar made red and viscous. It's the condiment of choice for people who order off the kid's menu. Mustard, though, is beguiling and complex. From sweet to sinus-scorchingly spicy, mustards can thrill all the tongue's taste buds.

Yes, we know there are those who use both the king and the queen of condiments, but we think those people just lack commitment.

Similarly, there are Ford Mustang people and Chevy Camaro people. And there are fans of turbos and adherents to naturally aspirated mills. Convenient, then, that we just happen to have a Heinz-red Mustang EcoBoost and a French's-yellow Camaro LT V-6. And if you think this sounds like a very elaborate scheme to justify expensing a lunch of old-school sliders and fries at southwest Detroit's venerable Telway Hamburgers stand, well, you're not entirely correct.

That's because in any war between turbocharged engines and naturally aspirated ones, the Mustang/Camaro battle is unique, important, and extremely worthy of contemplation. As of this year, each company serves up its sports coupe with a choice of three engines: a turbocharged four-cylinder, a V-6, and a V-8. Where the two companies differ is in the placement of these engines in their hierarchies. Ford, the first to turbocharge its current model,



IN PONY CARS AS IN CONDIMENTS, SPICINESS TRUMPS SWEETNESS.



regards the EcoBoost as its middle-rung Mustang—the performance-oriented pony car for those who don't want to pony up for the V-8. It's powered by a 310-hp 2.3-liter four-cylinder and is offered with the full complement of performance- and luxury-enhancing options. The base Mustang is the one powered by the 300-hp 3.7-liter V-6. It is mostly foisted on rental-car companies, and Ford offers it with none of the

options that a performance enthusiast might crave.

Chevrolet flips the order. A newly available 275-hp turbocharged 2.0-liter four-cylinder powers the base-level Camaro. The version priced and positioned to go against the EcoBoost Mustang is the one powered by the new 335-hp 3.6-liter V-6.

We specified six-speed manuals for our two performance-minded non-V-8s, because we prefer manuals and because it allowed us to test each car's throttle response [see page 058]. Can a punchy, turbocharged four-cylinder usurp a higher-revving,



larger-displacement V-6 in a class of cars where driving exhilaration trumps fuel economy?

We would find out on a mix of our 10Best testing roads, expressways, and Detroit's cratered byways. We would also eat burgers and fries. With mustard.

[2] FORD MUSTANG ECOBOOST

We love the new Mustang. We named the Mustang GT to our 10Best list last year; the Shelby siblings, the GT350 and GT350R, made our list this year. The Mustang we haven't honored is the EcoBoost model.

We still love the attributes it shares with higher-performance models: the styling; the firm, progressive brake pedal; the tune of its all-independent suspension; its easy, everyday-usable demeanor. But we do not love the engine. We respect it. The turbocharged, direct-injected 2.3-liter four makes ample power. There's enough juice to push the 3632-pound Mustang from zero to 60 mph in a respectable 5.6 seconds, only a tenth behind the lighter Camaro. Driven hard, the Mustang EcoBoost delivers 20 mpg,

compared with the Camaro V-6's 19 mpg over the same roads. The EcoBoost technically delivers on the two main promises of downsized turbocharged engines compared with larger naturally aspirated lumps: essentially equal performance with at least marginally better fuel economy.

And, as is usually the case with modern turbo engines, this one generates excellent midrange torque. Its peak twist of 320 pound-feet arrives at 2500 rpm. The Camaro V-6 generates 284 pound-feet at 5300 rpm. That makes the EcoBoost Mustang easy to live with. You don't need to do a great deal of shifting since there's ready thrust throughout the middle chunk of the rev range. Thing is, we like shifting, especially in performance cars. It's fun.

But making a satisfying turbo engine is not just about making the requisite power and reducing, as much as possible, turbo lag. This one is sadly lacking in the qualitative aspects. First, it's not particularly smooth. Get on the throttle and the engine sends waves of vibration through the steering wheel and shifter. And these are not the thrilling vibes sent from, say, the GT350's V-8. They are rather just lack of refinement with no particular payoff. The vibrations

don't intensify with greater revs in a way that might signify to your brain that the engine is an eager participant in the search for speed. Instead, it's just flat grumbling.

The same is true of the engine noise. It's a one-note song, and not a particularly pleasant note at that. This one's a groaner, always groaning the same groan. Its volume changes in concert with revs, but its pitch never does. There's not much point in exploring the upper reaches of this engine's operational envelope. There's no aural reward for pushing beyond 5500 rpm, where horsepower peaks.

It's a shame, too, because the Mustang is otherwise great fun to drive. Its shifter feels better than the Camaro's. And the harder you drive the car, the better and more settled it feels.

[1] CHEVROLET CAMARO V-6

Here was the moment the Camaro sealed its win in this quasi-comparison test: I was in the Mustang, cruising along on a slow portion of our 10Best testing roads behind executive online editor Erik Johnson in the Camaro. When the road opened up, Johnson floored the throttle. I followed suit. And I was treated to the full immersion experience that is the Chevy's exhaust. Our test Camaro came with the optional two-mode exhaust, which opens up butterfly valves and cranks the volume in response to heavy throttle. Because the Mustang is pretty much just as fast as the Camaro, I could hang with Johnson and listen as the Camaro's combustion song rose to its tremulous highs somewhere around the engine's 6800-rpm power peak.

Right at the upper edge of revs, the Camaro's exhaust begins to resonate at a frequency that makes your ears feel as if they're stuffed with cotton. It calls to mind the audio of old sports-car-racing footage where the microphones would become overwhelmed by the noise. Each upshift restarts the song, a rising ripsaw until the exhaust system and your ears can't accept it anymore. Then a moment of relief, then another rising ripsaw. We could listen to this auditory tension-and-release sequence all day.

The EcoBoost has its work cut out for it against the Camaro's new direct-injected V-6, which is a harlot of an engine; smooth enough for polite company but nasty when you want it to be. We've run a six-cylinder Camaro to 60 mph in as little as 5.1 seconds, but even at 5.5 seconds in this test, the V-6 is probably only about a second slower to that mark than the Camaro SS with its stonking 455-hp 6.2-liter V-8 (when equipped with a manual transmission). And that might be the ultimate measure of the two middle-rung cars we've tested here: How often while driving one of them would you regret not having purchased the V-8? The answer is, in the case of the Camaro, not very often. In the Mustang the answer would be always.

The sensory experience is paramount in performance cars. In that context, a good naturally aspirated engine has a built-in advantage. That the Camaro's chassis and seats and steering and turn-in response are better than the Mustang's makes awarding the win to the Chevy all the more easy. Also, mustard.



THE CAMARO'S RIPPING EXHAUST LIVENED THINGS UP ON A DREARY DETROIT DAY. THE MUSTANG'S? NOT SO MUCH.

	CHEVROLET CAMARO LT RS V-6	FORD MUSTANG PREMIUM ECOBOOST
VEHICLE		
VEHICLE TYPE	front-engine, rear-wheel-drive, 4-passenger, 2-door coupe	front-engine, rear-wheel-drive, 4-passenger, 2-door coupe
PRICE AS TESTED	\$38,815	\$32,540
BASE PRICE	\$30,140	\$30,545
ENGINE TYPE	DOHC 24-valve 3.6-liter V-6, aluminum block and heads, direct fuel injection	turbocharged and intercooled DOHC 16-valve 2.3-liter inline-4, aluminum block and head, direct fuel injection
POWER HP @ RPM	335 @ 6800	310 @ 5500
TORQUE LB-FT @ RPM	284 @ 5300	320 @ 2500
TRANSMISSION	6-speed manual	6-speed manual
CURB WEIGHT	3484 pounds	3632 pounds
C/D TEST RESULTS		
ACCELERATION		
0-30 MPH	1.9 sec	2.0 sec
0-60 MPH	5.5 sec	5.6 sec
0-100 MPH	14.4 sec	13.4 sec
0-130 MPH	29.0 sec	26.2 sec
1/4-MILE @ MPH	14.2 sec @ 99	14.0 sec @ 102
ROLLING START, 5-60 MPH	6.2 sec	6.4 sec
TOP GEAR, 30-50 MPH	12.7 sec	15.1 sec
TOP GEAR, 50-70 MPH	10.9 sec	8.3 sec
TOP SPEED	151 mph (gov ltd)	148 mph (gov ltd)
BRAKING, 70-0 MPH	153 feet	156 feet
ROADHOLDING,		
300-FT-DIA SKIDPAD	0.89 g	0.94 g
EPA CITY/HWY	18/27 mpg	22/31 mpg
C/D OBSERVED	19 mpg	20 mpg



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HITTING THE THROTTLE

TURBOCHARGED engines make big torque at low rpm, but those two numbers, peak torque and its corresponding rpm, don't tell the full story, as boost pressure isn't solely a function of engine speed. A turbocharger's ability to make boost (and inflate torque) depends on the energy in the exhaust stream that spins its turbine.

The peak engine output that automakers advertise and owners brag about is measured in laboratories where engines are held at a constant rpm with the throttle wide open and the turbo can take its sweet time spooling. That time is a key characteristic, rarely reported but highly telling, of a boosted engine's responsiveness. Porsche engineers acknowledge that the newly turbocharged 911 Carrera needs a full three seconds at wide-open throttle to achieve its maximum torque at 1800 rpm.

On the road, that delay is actually shorter because the revs rise as soon as you mat the throttle. Still, the hesitation can be felt during the transition from steady-speed cruising with a small throttle opening to full-wood acceleration. It takes time, a.k.a. the infamous turbo lag, before the engine's pistons pump enough hot exhaust to accelerate the turbine and produce boost from the compressor.

To quantify what a driver feels from behind the wheel, we instrument-tested the naturally aspirated V-6 Chevy Camaro and the turbocharged four-cylinder

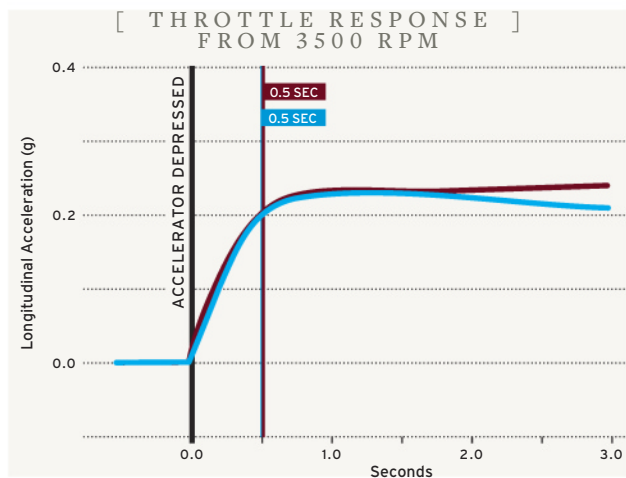
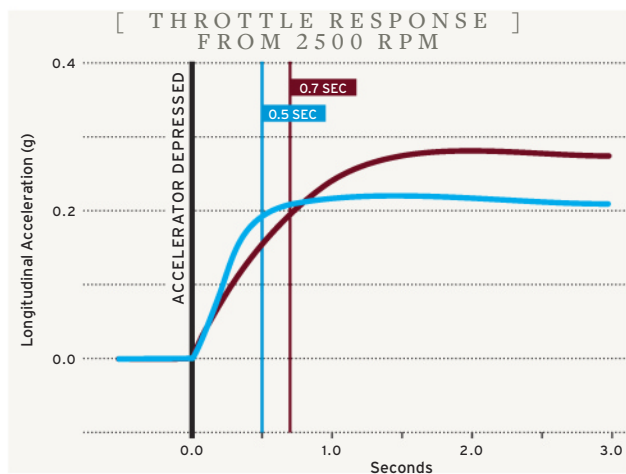
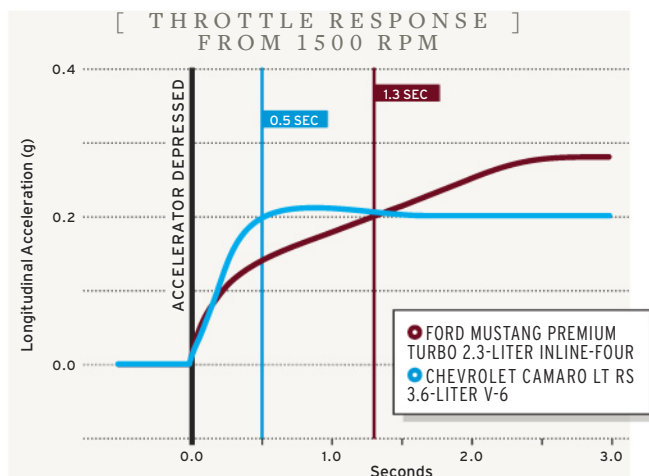
Ford Mustang and tracked how quickly their engines respond to sudden transitions. We cruised at constant rpm, then floored the throttle and measured the time it takes the vehicles to reach a longitudinal acceleration of 0.2 g. To prevent either car from having an advantage with a lower gear ratio, we used fourth gear, where the Mustang's overall ratio is just 0.3 percent shorter than the Camaro's.

Starting from 1500 rpm, the Camaro walks away from the Mustang, reaching the 0.2-g mark 0.8 second before the Ford. The Camaro holds on to its advantage when starting from 2500 rpm, where the Mustang makes its peak torque of 320 pound-feet, but there the gap narrows to just 0.2 second.

By 3500 rpm, however, the Ford's lag is minimal enough to capitalize on its flat torque curve, matching the Camaro in the race to the acceleration benchmark. The higher initial rpm increases the exhaust-flow rate and requires a larger throttle opening to maintain a constant speed, so at 3500 rpm, the Mustang's turbocharger is nearly up to boost speed even before the throttle swings completely open.

The lesson? Turbocharged engines may claim fat torque curves starting from low rpm, but they're significantly more responsive if you drive them as you would a naturally aspirated engine: Downshift, then accelerate.

— Eric Tingwall



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[P.060] [TURBO VS. NATURALLY ASPIRATED]

TOW



FORD F-150 LARIAT
CREW CAB 4WD
5.0-LITER V-8

RETOW

**Twin-turbo six or conventional eight:
Which works better in a full-size truck?**

[BY JARED GALL]

[PHOTOGRAPHY BY ROY RITCHIE]



FORD F-150 LARIAT
CREW CAB 4WD
TWIN-TURBOCHARGED
3.5-LITER V-6

W

hen it comes to trucks, the engine inspires as much loyalty as the vehicle it powers. Mazda's Skyactiv or Hyundai's Tau engines will never haul in the licensing profits of the Power Stroke, Duramax, or Cummins names. And in light-duty trucks, the displacement also becomes the brand. A Ram isn't just powered by a Hemi, it's a "Five-Seven." A Silverado destined to earn its living better have the "Six-Two." And if you were serious about building an F-series for work, it used to be that you ordered the old "Five-Four."

So Ford positioning its puny 3.5-liter twin-turbo EcoBoost V-6 atop the F-series lineup caused more than a few observers to choke on their chew. To see how the power structure shakes out, we lined up two nearly identical F-150s: one with the 5.0-liter V-8, one with the 3.5-liter twin-turbo EcoBoost V-6. Both are four-wheel-drive crew cabs with 5.5-foot beds. They pack the same six-speed automatic and 3.55:1 final-drive ratio. Aside from the turbocharged truck's option to display a digital boost gauge, the interiors are indistinguishable. Even the paints are similar



shades, just in case UV saturation affects weight. The EcoBoost F-150 did, however, come in 213 pounds heavier, in part due to its dual-pane sunroof and the FX4 package's skidplates.

The powertrains are closely matched. The 5.0-liter makes 385 horsepower at 5750 rpm; the EcoBoost, 365 at 5000. But the V-6 has a big lead in torque, 420 pound-feet to 387, and it peaks 1350 revs lower than the V-8, at 2500 rpm. We took our pair to the test track and, after the regular procedure was complete, hooked a pair of identically loaded 6400-pound trailers to the hitches for extra acceleration and fuel-economy tests. And with that, deciding a finishing order got a little complicated.

[2] 5.0-LITER V-8

Unladen, the 5.0 trails the EcoBoost to 60 mph by a half-second, taking 6.3 seconds versus 5.8. With trailers in tow, that gap grows to nearly two full seconds. From behind the wheel, the difference is astounding. Not that this should come as a surprise: Ford rates the EcoBoost's towing capacity higher than the V-8's, and our four-wheel-drive V-6 is rated to pull 11,500 pounds to the V-8's 9000. (We chose less than the maximum load to represent what these trucks are more likely to encounter in everyday use.)

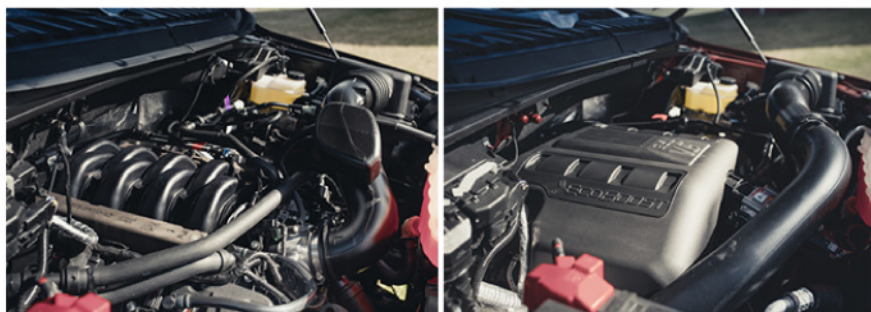
Still, such a significant load shines an unforgiving light on powertrain weaknesses. Laden, the V-8 needs a lot more pedal travel and a lot more revs than the EcoBoost does. From cruising speed, if you roll into the V-8's throttle, you just keep on rolling in deeper and deeper until the throttle is wide open, waiting for a few more mph. With more than three tons out back, even moderate acceleration calls for full throttle or nothing. Under partial throttle, the turbocharged six gets things done that the V-8 can't.

With the trailers unhitched, we appreciated the eight's softer power delivery. In something so brick-shaped, any throttle prod necessitates a downshift regardless of the engine. But with the EcoBoost, those downshifts drop you into the meat of the torque band. We had to recalibrate our ankles to feather the six's throttle a little to keep from surging forward. The eight's natural power build results in smoother downshifts and acceleration.

FORD F-150
LARIAT CREW
CAB 4WD
5.0-LITER V-8

FORD F-150
LARIAT CREW
CAB 4WD
3.5-LITER
ECOBOOST V-6

VEHICLE		
VEHICLE TYPE	front-engine, rear-/4-wheel-drive, 5-passenger, 4-door pickup	front-engine, rear-/4-wheel-drive, 5-passenger, 4-door pickup
PRICE AS TESTED	\$57,240	\$60,315
BASE PRICE	\$47,725	\$48,325
ENGINE TYPE	DOHC 32-valve 5.0-liter V-8, aluminum block and heads, port fuel injection	twin-turbocharged and intercooled DOHC 24-valve 3.5-liter V-6, aluminum block and heads, direct fuel injection
POWER HP @ RPM	385 @ 5750	365 @ 5000
TORQUE LB-FT @ RPM	387 @ 3850	420 @ 2500
TRANSMISSION	6-speed automatic	6-speed automatic
CURB WEIGHT	5220 pounds	5433 pounds
C/D TEST RESULTS		
ACCELERATION		
0-30 MPH	2.3 sec	1.9 sec
0-60 MPH	6.3 sec	5.8 sec
0-100 MPH	16.5 sec	16.2 sec
1/4-MILE @ MPH	14.9 sec @ 95	14.6 sec @ 95
ROLLING START, 5-60 MPH		
6.6 sec	6.4 sec	
TOP GEAR, 30-50 MPH	3.5 sec	3.4 sec
TOP GEAR, 50-70 MPH	4.5 sec	4.5 sec
0-60 MPH WITH 6400-POUND TRAILER	13.4 sec	11.7 sec
1/4-MILE @ MPH WITH 6400-POUND TRAILER	19.8 sec @ 72	18.6 sec @ 73
TOP SPEED	106 mph (gov ltd)	106 mph (gov ltd)
BRAKING, 70-0 MPH	188 feet	182 feet
EPA CITY/HWY	15/21 mpg	16/22 mpg
C/D OBSERVED	16 mpg	16 mpg
C/D OBSERVED WITH 6400-POUND TRAILER	10 mpg	9 mpg



IN A BEAUTY CONTEST, THE 5.0-LITER V-8 AND THE 3.5-LITER V-6 ECOBOOST BOTH LOSE. BUT THE TRUCKS LOOK GOOD NEXT TO BARN.

And, surprisingly, the V-8 bettered the V-6 in fuel economy, the two tying while unladen and the 5.0 eking out a single-mpg lead while towing. As with other turbocharged engines, staying in the boost means consuming fuel. And as we barreled into a 25-mph headwind on our fuel-economy run, the boost gauge showed in real time how hard the six was battling the atmosphere. But while the “Eco” part of the turbo six’s designation is a stretch, the smaller engine’s capability is undeniable.

[1] TWIN-TURBO 3.5-LITER V-6

Modern truck styling is equal parts International semi, Hamilton Safe, and well-marbled T-bone. Braggadocio matters with pickups. You might think that convincing buyers to give up the engine configuration that has powered nearly every iconic American vehicle over the last six decades would be a tough sell. But Ford claims the EcoBoost 3.5 is the highest-volume engine in the F-150 now. It can’t hurt that it costs just \$600 to upgrade from the V-8 to the turbo V-6.

Unburdened, the EcoBoost six lunges forward with an eagerness the V-8 can’t muster. But the twitchy part-throttle power delivery is annoying and might have meant a different finishing order if not for the trailering portion of our test. The ease with which the Eco-

Boost hauls a load—from a stop, under rolling acceleration, and cruising—positively embarrasses the eight. “But what about turbo lag?” traditionalists may whimper. A brief history of the term “lag”: It was coined at a time when the phenomenon meant you’d flat-foot the throttle and think, “Hmm, is something wrong?” furrow your brow and glance down at the shifter to make sure it was in the right gear, and finally feel the power start to come on several Mississippi after first demanding it. Modern turbochargers and engine controls mean that

in the Ford, you get maybe a quarter of the way through “Hmm” before the full whack of torque eliminates your concerns.

Engineers were clearly hedging against cylinder-count bias when tuning the sound that is piped through the EcoBoost’s stereo. From the outside, the EcoBoost sounds like a turbo V-6. Inside, it’s not quite the barrel-aged Americana of the 5.0’s intake snort, but it’s close. This six has a better V-8 sound than a lot of actual V-8s. We had to find the boost gauge in the instrument cluster to make sure we hadn’t lifted ourselves into the wrong truck.

We can’t imagine a day when anybody tunes a V-8 to sound more like a V-6, and yet the 5.0’s engineers would do well to emulate the EcoBoost’s eagerness. They may not get a chance. We hear rumors that the 5.0-liter will be pulled from the F-150 next year. It seems like the time has come. Yes, the 5.0-liter is more relaxed and easier to live with in daily commuting. But in hardworking F-150s, twin turbos handily trump an extra pair of cylinders.

A FULL-SIZE PICKUP ONCE SEEMED THE LEAST LIKELY HOME FOR A DOWNSIZED TURBO ENGINE. NOT ANYMORE.



HONDA CIVIC TOURING
TURBOCHARGED 1.5-LITER
INLINE-FOURHONDA CIVIC EX
2.0-LITER INLINE-FOUR

A TALE OF TWO CIVICS

TURBOCHARGERS may be synonymous with big power and torque, but automakers have a very different motive for embracing forced induction. Smaller turbo engines fare better than naturally aspirated ones with similar performance on the EPA's granny-like driving schedule. However, it's not always clear if the fuel-economy advantage holds up on public roads with quicker acceleration and higher speeds.

To sniff out the real-world differences, we tested two Honda Civic sedans, each with the CVT, but one with the 174-hp turbocharged 1.5-liter four-cylinder and one with the 158-hp naturally aspirated 2.0-liter. By the EPA's measure, the turbo Civic holds a 1-mpg edge on the highway with its 31/42-mpg ratings.

On a 300-mile loop of mixed highway, rural, and

urban driving, the cars proved equally frugal by averaging 40 mpg. Digging deeper, we measured the steady-speed fuel consumption of the two Civics. Some of our results are astounding, such as the 50-plus-mpg both Civics achieve at 55 mph. The turbo wins across speeds ranging from 30 to 90 mph, with a 6-mpg advantage between 40 and 55 mph.

To generate the power required to maintain a particular cruising speed, any engine—small or large—must pump a corresponding amount of air. With equivalent gearing, the smaller engine requires a wider throttle opening to pump the same amount of air as a larger engine. Because pumping losses are lower with wider throttle openings, a smaller engine is more efficient.

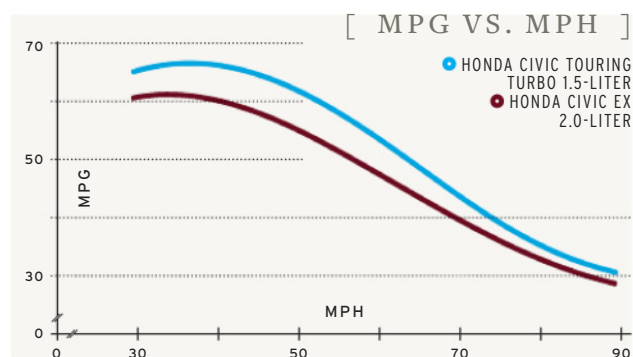
Even at 90 mph, with the

tach reading 2800 rpm, the turbo plays a minor role in cruise mode. This is precisely why nearly every carmaker will rely heavily on smaller-displacement, boosted engines to satisfy the fuel-economy mandate that requires a fleet-wide average of 54.5 mpg by 2025.

Spending the extra \$1160 for the Honda's turbo engine does have one clear advantage beyond efficiency: The

additional power and torque clip 1.4 seconds from the zero-to-60-mph run and a full second off the quarter-mile time compared with the naturally aspirated alternative. But exceed the gentle, twinkle-toe throttle pressure we applied in our steady-speed tests and all efficiency bets are off. As boost rises, more fuel is injected and mileage drops. Precipitously.

—Don Sherman



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MAZDA 3 s GRAND TOURING
2.5-LITER INLINE-FOUR



It is difficult to argue against a hatchback Mazda 3 or a Volkswagen Golf. Either works well enough at enough tasks that it can be safely recommended, always and to anyone. Which, of course, we do. The current generations of the 3 and the Golf have won spots on our 10Best list since their inceptions, thanks to excellent combinations of performance, utility, and value. Liked by all, loved by some, these are known quantities, as familiar as our own children.

In fact, examples of each have been demanding our time and attention for months now, with a pair of long-term test cars parked here at Eisenhower Place. We even pressed one

of them, the website's Tornado Red Golf, into service for this comparison, matching it with a 3 in Soul Red. Both cars are equipped with conventional automatic transmissions and carry window stickers within a thousand bucks and change of each other.

We wanted manual gearboxes for this test, but Volkswagen offers the Golf with a five-speed only and then only in lower trim levels. We actually tried doing it this way, but it felt unfair: The Mazda cost about 40 percent more, and its six-speed manual was slick enough to make shifting in the VW feel like digging a hole with a gardening spade.

[FEATURE] [JUNE 2016] [P.067]

TRANS STATION

The perfect car for anybody meets
the best car for everyone.

[BY JEFF SABATINI]

[PHOTOGRAPHY BY MARC URBANO]



↑
VOLKSWAGEN GOLF TSI SEL
TURBOCHARGED 1.8-LITER INLINE-FOUR

Sitting atop the basic Golf range is the well-equipped SEL trim. You can spend more on a VW hatchback, but it will have a GTI badge or an R decorating its rump. VW raised the price by \$430 since we took delivery of our 2015 model, but it also upgraded the Golf's woeful infotainment system with a new 6.5-inch touchscreen that's compatible with Android Auto and Apple CarPlay. Buying an identical 2016 would set you back \$29,240. That makes the Mazda 3 s Grand Touring's \$30,285 sticker still the more expensive one, but a \$1750 appearance package and a \$300 charge for its metallic paint were among its options. In terms of pricing, at least, the advantage could easily have swung toward either car depending on the add-ons.

That theme, of alternating advantages, would dominate this test. Like the others in this section, the focus was on what's under the hood. We knew we liked the linearity of the naturally aspirated 2.5-liter four in the Mazda 3, but jumping behind the wheel of the Golf would have us praising the swollen torque curve of its turbocharged 1.8-liter four. The specifications and test numbers for most metrics were close enough that math would not be the overriding factor here. Yet the longer we drove, the more we went in figurative, if not literal, circles. Even as we sought to focus on the relative merits of their engines, we kept getting distracted. Each of these vehicles hews consistently to a philosophy, and in each case it makes the car seem fully realized and at peace with itself.

The Mazda feels light, yet at times, particularly on bad roads, that translated to an impression of inexpensiveness. The VW seems



CHOOSING BETWEEN THE MAZDA 3 AND THE VW GOLF IS LIKE PICKING OUR FAVORITE CHILD. BUT CHOOSE WE MUST.

forged out of a single piece, and it looks it, too. The car resembles nothing less than a solid block of metal—or an older Golf. The 3, on the other hand, which was bedecked with aero pieces, is all outré style, a J-pop star. Both cars handle well; the Mazda leans more and has quicker steering, while the VW has better body control and trumps the 3 in feedback. Inside, the 3 is flashy while the Golf is correspondingly somber and serious. These are their two tropes; the biggest challenge is deciding which one best represents you.

	MAZDA 3 s GRAND TOURING	VOLKSWAGEN GOLF TSI SEL (2015)
VEHICLE		
VEHICLE TYPE	front-engine, front-wheel-drive, 5-passenger, 4-door hatchback	front-engine, front-wheel-drive, 5-passenger, 4-door hatchback
PRICE AS TESTED	\$30,285	\$29,240*
BASE PRICE	\$26,280	\$28,245*
ENGINE TYPE	DOHC 16-valve Atkinson-capable 2.5-liter inline-4, aluminum block and head, direct fuel injection	turbocharged and intercooled DOHC 16-valve 1.8-liter inline-4, iron block and aluminum head, direct fuel injection
POWER HP @ RPM	184 @ 5700	170 @ 4500
TORQUE LB-FT @ RPM	185 @ 3250	199 @ 1600
TRANSMISSION	6-speed automatic	6-speed automatic
CURB WEIGHT	3071 pounds	3122 pounds

C/D TEST RESULTS		
ACCELERATION		
0-30 MPH	2.4 sec	2.4 sec
0-60 MPH	6.8 sec	7.3 sec
0-100 MPH	19.0 sec	20.1 sec
0-120 MPH	33.6 sec	37.5 sec
1/4-MILE @ MPH	15.4 sec @ 92	15.6 sec @ 90
ROLLING START		
5-60 MPH	7.1 sec	7.7 sec
TOP GEAR, 30-50 MPH	3.6 sec	3.6 sec
TOP GEAR, 50-70 MPH	4.7 sec	5.1 sec
TOP SPEED		
132 mph (gov ltd)		126 mph (gov ltd)
BRAKING, 70-0 MPH	171 feet	168 feet
ROADHOLDING		
300-FT-DIA SKIDPAD	0.84 g	0.86 g
EPA CITY/HWY	27/37 mpg	25/36 mpg
C/D OBSERVED	29 mpg	29 mpg

*2016 model-year price.

[2] VOLKSWAGEN GOLF

The Golf's turbo four delivers a rush of torque, 199 pound-feet of it, between 1600 and 4400 rpm. It is as exhilarating as it is deceptive, producing the sort of endorphin release that consistently makes us forget what happened immediately prior, which was, well, nothing. If you want to know why the Golf finishes second, blame its throttle response, which has all the urgency of Wolfsburg answering its mail from the EPA.

From a standing stop, the VW is at its worst. The transmission is as dimwitted as the throttle is recalcitrant. After depressing the accelerator, the driver (and the turbo) is left waiting far too long for either one to respond. Once that single-scroll turbocharger spools, however, the Golf feels quick, and in traffic it surges ahead for confident passing. Use the small, steering-wheel-mounted paddles to short-shift the six-speed automatic at the engine's 4500-rpm power peak rather than its 7000-rpm rev cutoff and you'd never suspect that the Volkswagen, at 170 horsepower, is down 14 to the Mazda.

Get the Golf up to speed and the turbo barely lags, though the throttle still feels damped compared with that of the Mazda. Even though we recorded identical 3.6-second 30-to-50-mph acceleration runs at the proving ground, the Volkswagen felt like the rabbit of the pair in around-town driving. The Golf revs quickly while riding that wave of midrange torque, and—unlike the 3—it does so without drama.

Our measurements showed the Golf to be louder than the 3, but our ears told us differently. The turbo four emits a deeper tone that's much less obtrusive in the cabin. You can listen to the radio at a

reasonable volume in the Volkswagen and still carry on a conversation with a passenger; in the Mazda you'd need to have the stereo cranked and then shout over it to make yourself heard.

The comparatively rapid descent of the Golf's gas gauge led us to believe that we might be paying a penalty for the turbo, yet that turned out not to be the case. Both cars got the same 29 mpg during our drive.

The Golf is a car for grown-ups. It is softer and more comfortable than the 3, especially when approaching the traction limit. The Volkswagen never really encourages you to go fast, responding merely with unperturbed grace when you do. We love living with it, perhaps even more than we enjoy driving it.

[1] MAZDA 3

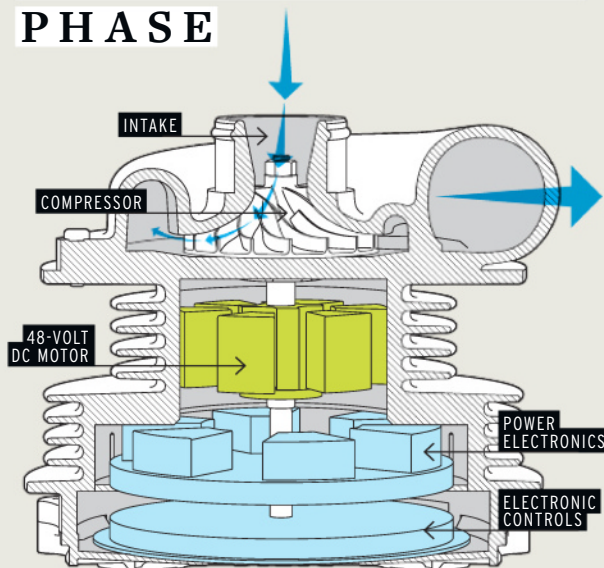
We said in the introduction that the numbers wouldn't be the deciding factor in this comparison test, although there's one that we need to mention: 6.8. As in, seconds the 3 needs to reach 60 mph, or a half-second quicker than the Golf. That's too large a difference to ignore, but don't misunderstand us; the zero-to-60 is just one telltale of the engine's capability, not the sole hook on which we hang the win.

Punch it in the 3 and you are rewarded with a corresponding reaction. Throttle response is immediate, and in sport mode the transmission is sharp enough that shifting is almost seamless. Keep your foot down and the rewards grow. Once you hit the torque peak of 185 pound-feet at 3250 rpm, the Mazda starts burying each big mark on the tachometer more rapidly than the one before it. Past 5000 rpm, the 3 comes alive at precisely the same place in the rev range where the Golf goes to sleep. At high revs, the Mazda's right pedal feels like a hair-trigger, and the wailing intake and brassy exhaust make the 3 sound like a Miata hatchback.

The Mazda hits its 184-hp peak at 5700 rpm, but it still feels strong when it shifts abruptly at 6200 rpm. The first time it happens, you'll swear the big 2.5-liter four has another thousand revs in it and a dozen ponies or so waiting there. But switching the six-speed into manual-shifting mode reveals that 6200 is the hard limit. Bounce the needle against it for a few futile seconds and the transmission will shame you by upshifting.

The 3 requires more effort, more revs, and more noise to translate those test-track acceleration numbers into real-world performance. The VW was easier to keep in the meat of its powerband, allowing for a lazier driving style without dropping off the pace. It's likely better suited to shuttling the kids and picking up the dry cleaning. But that's ultimately the reason why the Mazda wins. It's the car that asks for more effort—indeed, more driving—but pays out with more enjoyment. ■

GOING ELECTRIC: BOOSTING'S NEXT PHASE



NOT LONG AGO, the only info about electric supercharging in these pages was in the classified section next to a male-enhancement ad. Only one of those products actually worked.

Electric supercharging, long rumored but never fully realized, is finally happening. Audi's upcoming SQ7 TDI pairs an electric supercharger with sequential turbos on the SUV's 4.0-liter diesel V-8. It's a first for a production vehicle.

As with a conventional centrifugal supercharger, an e-supercharger uses a traditional compressor wheel but drives it with an electric motor rather than a crank-driven belt. E-superchargers draw their power from batteries or capacitors, which can be charged via regenerative braking or, in the case of the SQ7, a beefy generator and a 48-volt sub-system.

The biggest benefits of e-supercharging are power and response, particularly at low engine speeds. Because an e-supercharger's ability to create boost is not coupled to exhaust energy or engine rpm, it offers flexibility not found in

alternatives. Though traditional turbocharging remains a more efficient means of adding power, it has drawbacks such as lag.

As engines downsize and pressurize, e-supercharging offers the ability to size a compressor for a power target without sacrificing low-rpm drivability. It does so by filling in the torque-less void below the turbo's threshold for creating boost. This is exactly how Audi is using the Valeo-supplied electric supercharger in the SQ7 TDI.

Electric superchargers won't replace turbos, but they allow for the optimization of turbos and other technologies. For example, deactivated cylinders can remain dormant longer when supported by e-supercharging. And in Miller-cycle engines, which have a longer-than-normal expansion ratio, an electric blower can replace a traditional supercharger to reduce parasitic losses. Valeo describes its e-supercharger as an enabling technology, which gives it at least one thing in common with those male-enhancement products.

—Josh Jacquot





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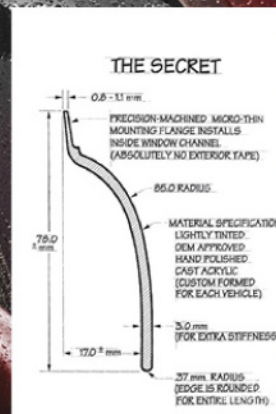
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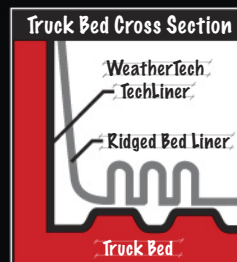
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QUIET, PLEASE

—
THE NEW A4 IS
A ROLLING
DO-NOT-DISTURB SIGN.
THERE'S SOME
LUSTINESS BEHIND THE
DOOR, THOUGH.

by Tony Quiroga
photography by Jessica Lynn Walker

Silence is golden, especially in an election year. But in a sports sedan, silence can be eerie. Absent the sound of hot air ripping through an exhaust, can you really be sure you're in a car that performs?

In the case of the 2017 Audi A4 2.0T Quattro, the sound-level meter confirms its soft-spoken nature. At a steady 70 mph, the A4 puts out a mere 63 decibels. That's less noise than you'll get in an S-class, Audi's own A8, and the sensory-deprivation tank also known as the Lexus LS600hL. A Rolls-Royce Phantom is quieter, but only by one decibel. Point the A4 down a highway and all you hear is a light ruffling of wind—and watch your speed, the A4 is barely louder at 100 mph.

Some of the credit for the silence has to go to the new A4's low, 0.27 drag coefficient. But it isn't just the wind that barely notices the new sheet-metal; people's gazes will slip right off it as well. The design, a modest evolution of the old A4, isn't exactly eye-catching. But that doesn't mean there's a bad line on the car. Indeed, there is a great line,



a crease that runs along the side and into the shut-line of the clamshell hood. At the tail end, Audi has finally figured out how to get its thin band of sweeping LED turn signals past U.S. regulators.

Under that thick veil of conservatism and refinement, however, is indeed a sports sedan. Rev it up, and the turbocharged inline-four's bark pierces the calm. The four-cylinder is a variation of the engine that powered the previous A4, iron block and all, but enhancements to the head and turbocharger bring output to 252 horsepower at 6000 rpm and 273 pound-feet of torque at 1600 rpm, up from 220 horses and 258 pound-feet. Snarly yet smooth, the four is free of lag and delivers a strong pull from idle to redline.

Connected to the engine is a seven-speed dual-clutch automatic that replaces a conventional eight-speed automatic. A six-speed manual will be available in early 2017. Audi informs us that it did extensive work to get the dual-clutch to match the feel of a torque-converter automatic when accelerating from a rest. It engages easily, smoothly, and predictably from a stop or a slow roll, although the transmission shares the old 'box's predilection to shift to the highest gear possible to boost mileage.

The big benefits to the dual-clutch, from our perspective, are its instantaneous shifts and launch control. To engage the latter, select the transmission's sport mode in drive, put stability control into sport mode, and simultaneously hold the brake and accelerator to the floor. Engine revs rise then settle at 3000 rpm, at which point you can release the brake. Four-wheel drive ensures a spin-free getaway, and the 3671-pound A4 hits 60 mph in 5.2 seconds, 0.4 second quicker than its predecessor and the same time as the latest rear-drive BMW 328i (we have yet to test a 328i xDrive). Stay on it and the quarter-mile passes in 13.9 seconds at 100 mph. Despite the Y-rated Hankook summer tires, a no-cost option, U.S.-market A4s are governed to 130 mph.

More-important numbers to Americans will be the EPA's fuel-economy estimates. The A4 Quattro returns 24 mpg in city and 31 in highway tests, which works out to 27 mpg combined. That's a 3-mpg improvement in the city and 1 mpg better on the highway versus the outgoing A4 2.0T. In



2017 AUDI A4 2.0T QUATTRO

⊕ A silent servant capable of taking care of the driving; wakes up and responds happily when the going gets interesting; technology that'll impress at the Genius bar; Audi still doesn't skimp on interiors.

⊖ The handling is stable instead of fun; overboosted steering is too light to feel secure at highway speeds.

⊖ The segment's total package with equal parts tech, luxury, and sportiness.

our hands, the car managed 22 mpg overall in a mix of highway driving and stop-and-go traffic, and after attacking Angeles Crest and Angeles Forest highways as if they were Group B rally stages.

As with every Audi sedan, the A4 has the majority of its weight over its front wheels, a product of four-wheel drive and of perching the engine ahead of the front-axle line. The Quattro four-wheel-drive system is set up to send 40 percent of the torque to the front and the remainder rearward, but the system constantly adjusts the split, front to rear. Grip from the Hankooks is good, at 0.90 g, and it's very usable and secure grip, but the A4 works its front tires harder and they give up sooner than those of the 3-series. To combat understeer, the A4 pulses its inside brakes to pull the car into the corner. But it's not enough to impart the sensation that the rear wheels are fully running the show.



Our nearly loaded test car came equipped with the adaptive damping suspension (\$1000) that lowers the ride height by 0.4 inch versus the base setting and adds electronically adjustable dampers with three modes: comfort, auto, and dynamic. A \$750 Sport package adds a firmer suspension that drops the car 0.9 inch, but it can't be paired with the adjustable shocks. With adaptive damping, the shocks will automatically change stiffness on their own or at the driver's command. In comfort mode, the ride wallows slightly before it tightens; auto is exactly right; and dynamic starts taut and only gets tauter.

The electrically assisted power steering is also adjustable, from 1970s American-car light to modern German light to just right. In auto and comfort modes, the steering's lack of heft imparts a slight sloppiness when the car is tracking straight ahead. Dialing up the effort by selecting sport helps eliminate some of the vagueness. Under cornering stress, the steering wakes up considerably and begins to approach the clear and lively feedback of Cadillac's ATS and CTS.

The brakes neither have nor need any adjustments. Audi fits every U.S.-bound A4 with four-piston front calipers, and the brake feel is superb. The pedal reacts precisely and with the right amount of bite. Hard stops from 70 mph take a Porsche-like 155 feet.



At a glance, you could mistake the new A4 for the old one. But there are upgrades throughout, such as the reconfigurable instrument screen, natty interior, and quick-shifting dual-clutch automatic.

079



tion worked safely and without any hiccups. Set the cruise on a back road and the car will automatically slow for sharp curves using GPS and map data. As equipped, there's more tech in the new A4 than in a six-figure A8. It's daunting at first, but you can just ignore it, not purchase it in the first place, or shut it all off. You may also choose to give up your last shred of independence and let the car drive itself.

It's more difficult to ignore the 12.3-inch LCD screen right behind the perfectly sculpted three-spoke steering wheel. Introduced on the TT, and now also on the Q7 and the R8, the display can be configured with either full-size or small gauges and the background can show a detailed Google map or trip information. Even in direct

Though excellent brakes are standard on U.S. A4s, the extensive technology on our car adds a lot of ducats to the bottom line. Base versions—Premium in Audi *Sprache*—start at \$38,250, and four-wheel drive adds \$2100. Standard equipment includes a sunroof, a rearview camera, leather seats, xenon headlights, power front seats, an auto-dimming mirror, 17-inch wheels, and Android Auto and Apple CarPlay. Selecting the Premium Plus trim level adds \$3800 and LED headlights, 18-inch wheels, a 755-watt 19-speaker Bang & Olufsen audio system, an anti-theft alarm, heated seats with memory, and the expensive-looking S-line body kit.

Our nearly loaded Prestige-package car, a \$4800 jump over the Premium Plus model, brings a head-up display, a digital

gauge cluster, and the Technology package that includes navigation, a larger center screen, blind-spot monitoring, and rear-end-collision warning. Thus, \$54,275 for the test car, which also features heat to the rear seats and steering wheel, cooled front sport seats, the electronically adjustable suspension, and the \$1800 Driver Assistance package that gives the A4 the ability to briefly drive itself. If you're the type who'll never use it, save the money. An A4 without the self-driving function, the head-up display, and a few other features such as heated rear seats can be had for \$47,750.

Since the A4 we tested had the ability to deal with stop-and-go traffic like an autonomous car, we felt obliged to turn on the cruise control and use it. In traffic-snarled Los Angeles, the self-driving func-

tion worked safely and without any hiccups. Set the cruise on a back road and the car will automatically slow for sharp curves using GPS and map data. As equipped, there's more tech in the new A4 than in a six-figure A8. It's daunting at first, but you can just ignore it, not purchase it in the first place, or shut it all off. You may also choose to give up your last shred of independence and let the car drive itself.

It's more difficult to ignore the 12.3-inch LCD screen right behind the perfectly sculpted three-spoke steering wheel. Introduced on the TT, and now also on the Q7 and the R8, the display can be configured with either full-size or small gauges and the background can show a detailed Google map or trip information. Even in direct sunlight, the display remains as legible and crisp as actual gauges. The rest of the interior is just as good, even when rendered in boring black. The A4 doesn't try too hard; its luxury is born of expensive plastics, real aluminum, artfully sculpted shapes, and switchgear that looks great and clicks satisfyingly in your hands. It's a soothing interior, too, from the shifter that doubles as a hand rest to the supportive sport seats.

In the final analysis, Audi's new A4 is a class leader in refinement, technology, and interior design. Its chassis dynamics and exterior haven't made as big a leap, but the car remains an adept, if secure, handler wrapped in an elegant four-door envelope. It doesn't make much noise about it, but the A4 possesses a quiet competence that is as wonderful as it is easily misunderstood.

080

06.2016

caranddriver.com

. road test

2017 AUDI A4 2.0T QUATTRO PRESTIGE

▼ SPECIFICATIONS

PRICE
AS TESTED \$54,275
BASE \$40,350

VEHICLE TYPE: front-engine, 4-wheel-drive, 5-passenger, 4-door sedan

OPTIONS: Driver Assistance package, \$1800; Warm Weather package, \$1450; adaptive damping suspension, \$1000; Manhattan Gray metallic paint, \$575; Cold Weather package, \$500

STANDARD: power windows, seats, locks, and sunroof; remote locking; cruise control; tilting- and-telescoping steering wheel

AUDIO SYSTEM: satellite radio; CD player; minijack, 2 USB, 2 media-card, and Bluetooth-audio inputs; Android Auto and Apple CarPlay interfaces; 19 speakers

ENGINE

turbocharged and intercooled inline-4, iron block and aluminum head

BORE X STROKE 3.25 x 3.65 in, 82.5 x 92.8 mm

DISPLACEMENT 121 cu in, 1984 cc

COMPRESSION RATIO 9.6:1

FUEL DELIVERY SYSTEM direct injection

TURBOCHARGER IHI RHF5

MAXIMUM BOOST PRESSURE 21.5 psi

VALVE GEAR: double overhead cams, 4 valves per cylinder, hydraulic lifters, variable intake- and exhaust-valve timing and exhaust-valve lift

REDLINE/FUEL CUTOFF 6750/6750 rpm

POWER 252 hp @ 6000 rpm

TORQUE 273 lb-ft @ 1600 rpm

DRIVETRAIN

TRANSMISSION 7-speed dual-clutch automatic with manual shifting mode

FINAL-DRIVE RATIO 4.23:1

4-WHEEL-DRIVE SYSTEM full time

GEAR	RATIO	MPH PER 1000 RPM	MAX SPEED IN GEAR (rpm)
1	3.19	5.5	37 mph (6750)
2	2.19	8.0	54 mph (6750)
3	1.52	11.5	78 mph (6750)
4	1.06	16.6	112 mph (6750)
5	0.74	23.7	130 mph (5500)
6	0.51	34.4	130 mph (3800)
7	0.39	45.0	130 mph (2900)

CHASSIS

unit construction with a rubber-isolated rear subframe

BODY MATERIAL: steel and aluminum stampings

STEERING

rack-and-pinion with variable electric power assist

RATIO 15.9:1

TURNS LOCK-TO-LOCK 2.8

TURNING CIRCLE CURB-TO-CURB 38.1 ft

★ NOTABLE HIGHLIGHTS

In Europe, this engine is equipped with both port and direct fuel injection. The port injection isn't needed to pass U.S. emissions tests, so our cars use only direct injection.

EXTERIOR DIMENSIONS

WHEELBASE	111.0 in
LENGTH	186.1 in
WIDTH	72.5 in
HEIGHT	55.8 in
FRONT TRACK	61.9 in
REAR TRACK	61.2 in

INTERIOR DIMENSIONS

SAE VOLUME	F: 52 cu ft R: 42 cu ft
TRUNK	13 cu ft

SUSPENSION

F: ind, 2 lateral links and 2 diagonal links per side, coil springs, 3-position cockpit-adjustable electronically controlled dampers, anti-roll bar

R: ind; 2 diagonal links, 2 lateral links, and a toe-control link per side; coil springs; 3-position cockpit-adjustable electronically controlled dampers; anti-roll bar

BRAKES

F: 13.3 x 1.2-in vented disc

R: 13.0 x 0.9-in vented disc

STABILITY CONTROL fully defeatable, competition mode, launch control

WHEELS AND TIRES

WHEEL SIZE 8.0 x 18 in

WHEEL CONSTRUCTION cast aluminum

TIRES Hankook Ventus S1 Evo2, 245/40R-18 97Y

▼ COMPETITORS

AUDI A4 QUATTRO (2.0-L I-4, 252 HP, 7-SP AUTO)

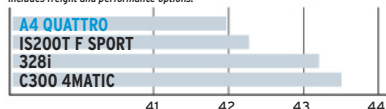
BMW 328i (2.0-L I-4, 240 HP, 8-SP AUTO)

LEXUS IS200T F SPORT (2.0-L I-4, 241 HP, 8-SP AUTO)

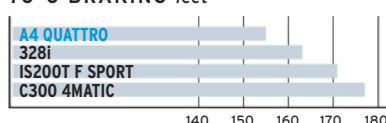
MERCEDES-BENZ C300 4MATIC (2.0-L I-4, 241 HP, 7-SP AUTO)

CURRENT BASE PRICE dollars x 1000

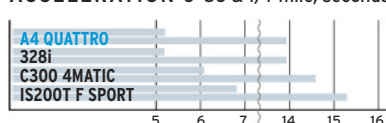
Includes freight and performance options.



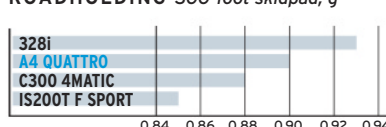
70-0 BRAKING feet



ACCELERATION 0-60 & 1/4-mile, seconds



ROADHOLDING 300-foot skidpad, g



CAR AND DRIVER TEST RESULTS

ACCELERATION

ZERO TO	SECONDS
30 MPH	1.8
40 MPH	2.7
50 MPH	3.8
60 MPH	5.2
70 MPH	6.8
80 MPH	8.7
90 MPH	11.0
100 MPH	13.9
110 MPH	17.3
120 MPH	21.9
ROLLING START, 5-60 MPH	6.0
TOP GEAR, 30-50 MPH	2.9
TOP GEAR, 50-70 MPH	3.8
1/4-MILE	13.9 sec @ 100 mph
TOP SPEED (GOV LTD)	130 mph

TEST NOTES: The dual-clutch gearbox's launch control revs the engine to about 3000 rpm before engaging the clutch. There's no wheelspin, and the A4 bolts away with seamless and quick upshifts. A brief whiff of turbo lag is evident in the rolling 5-to-60 acceleration run.

HANDLING

ROADHOLDING, 300-FT-DIA SKIDPAD **0.90 g**
UNDERSTEER MODERATE

TEST NOTES: The gummy Hankooks grip well and in silence, but the A4's front tires work hard. Understeer is secure and easy to manage, but it's also not much fun. Although light on-center, the steering livens up as the tires are pressed into the pavement.

BRAKING, 70-TO-ZERO MPH

FIRST STOP	154 ft
SHORTEST STOP	155 ft
LONGEST STOP	158 ft
FADE RATING	NONE

TEST NOTES: The front rotors are clamped by four-piston calipers. Brake feel is about perfect with the ideal amount of bite and no lost motion. The sticky Hankooks deserve some credit for the short stops from 70, but the brakes proved strong even after stops from 130.

WEIGHT

CURB	3671 lb
PER HORSEPOWER	14.6 lb
DISTRIBUTION F: 56.0% R: 44.0%	
TOWING CAPACITY	0 lb

FUEL

CAPACITY	15.3 gal
OCTANE	91 (required)
EPA CITY/HWY	24/31 mpg
C/D OBSERVED	22 mpg

INTERIOR SOUND LEVEL

IDLE	42 dBA
FULL THROTTLE	70 dBA
70-MPH CRUISING	63 dBA

tested by TONY QUIROGA
 in California City, California





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LONG-TERM TEST

— 2014 MINI COOPER S HARDTOP —

083

Making Lemonade

Twenty-one months with a little rascal of a Mini Cooper S. *by Eric Tingwall*



A Mini should be a joyful thing. The cheeky styling, quick reflexes, and punchy powertrain are supposed to be a playful escape from the anonymous sedans and me-too cross-overs that plug up exit ramps and make driving a chore. It should be whimsy on wheels.

But looking back over our 21 months with a 2014 Mini Cooper S, we're left hunting for happy thoughts. While it was clearly made to entertain, our Mini wasn't made particularly well. The majority of our miles were accompanied by a soundtrack of groans, rattles, squeaks, and *gronks* that soured our attitude toward the car.

Well, at least the first 10,000 miles passed innocuously. In the early days of our test, we admired the powertrain, lamented the flinty ride quality, and studied how the Mini has evolved. Fourteen years on, the re-imagined Mini has grown, both dimensionally

and characteristically. Longer than its predecessor by 5.1 inches, the third-generation Mini doesn't feel so miniature anymore. It's also a much more mature and refined car. The cabin is quieter than those of Minis past (when it doesn't sound like a cocktail shaker), and the interior is much easier to use, thanks in part to the excellent infotainment suite, which is essentially BMW's iDrive reskinned with brighter colors.

We determined, though, that a better Mini is still an ergonomically challenged Mini. The headlight control is hidden by the steering wheel and angled toward the floor, making it nearly impossible to discern the switch's different positions. Staffers railed against the tall and bulky center armrest, which makes it awkward to shift gears, use the navigation system's control

knob, or even prop up an elbow.

Drivers also noted how quickly and how far the Cooper S can drift from its \$24,395 base price. The Fully Loaded package added navigation, automatic climate control, a Harman/Kardon stereo, and a panoramic sunroof to our car for \$4500. We opted for the \$1500 leather seats, \$600 cold-weather package, a \$500 head-up display, \$300 for satellite radio, and \$250 for LED headlights with cornering lights. Lured by the dizzying array of choices on Mini's online configuring tool, we also ended up with a trio of ridiculous options for \$250 apiece: a rear spoiler that should be standard, a black headliner that should be a no-cost option, and a storage

package that includes a 12-volt outlet in the cargo area and a small elastic net in the passenger footwell that is patently useless.

The final price, \$33,795, became even tougher to swallow as the miles accrued. The word "rattletrap" first appeared in the logbook with 15,103 miles on the odometer and quickly multiplied on its pages. We learned to leave the cargo cover on the floor of the cargo hold, in the back seat, or at home—essentially anywhere but its intended position where it clacked and clattered. Unfortunately, there's no escaping the rear seatbelts. When not in use, their buckles beat noisily against the hard-plastic trim unless you worm your way back there to tuck them under clips.

In quieter but no-less-irritating follies, the upper-glovebox lid jammed in a not-quite-closed position, looking like a trim piece installed by fat-fingered Oompa-Loompas. After an internal gear mechanism in the driver's seat stripped, the backrest refused to lock back into place whenever someone climbed into the rear seat. The fix for that—replacing the seatback frame—only set off another cascade of problems. The trim surrounding the rear-seat-access lever came off in one staffer's hand (we popped it back into place ourselves), and the lumbar knob fell off on two separate occasions. When the badge eventually fell off the rear hatch, it was hard not to read it as our Cooper S waving a white flag of surrender.

But these were only the minor headaches we experienced.

Our suspension woes began at 16,000 miles with a knock from the front end and a



← Improved though they may be, the new Mini's ergonomics are still a dog's breakfast. Worse, various interior pieces broke or fell off.

2014 MINI COOPER S HARDTOP

▼ SPECIFICATIONS

VEHICLE TYPE: front-engine, front-wheel-drive, 4-passenger, 2-door hatchback
PRICE AS TESTED \$33,795
BASE PRICE \$24,395
ENGINE TYPE: turbocharged and intercooled DOHC 16-valve inline-4, aluminum block and head, direct fuel injection
DISPLACEMENT 122 cu in, 1998 cc
POWER 189 hp @ 6000 rpm
TORQUE 207 lb-ft @ 1250 rpm
TRANSMISSION 6-speed manual
WHEELBASE 98.2 in
LENGTH 151.9 in
WIDTH 68.0 in
HEIGHT 55.7 in
CURB WEIGHT 2839 lb

WARRANTY

4 years/50,000 miles bumper to bumper
 4 years/50,000 miles powertrain
 12 years/unlimited miles corrosion protection
 4 years/unlimited miles roadside assistance
 3 years/36,000 miles scheduled maintenance

MODEL-YEAR CHANGES

2015: Automatic climate control and rain sensor are standard. **2016:** Sport package now includes Dynamic Damper Control.

squeak at the rear. The dealer torqued the suspension hardware, cleaned the dampers, tightened a loose fuel-hose bracket, and sent us on our way. The noises made a comeback the following day. We returned within the month, and the service department replaced the left- and right-front control arms. That fix seemed to do the trick—for about 1000 miles. At the next visit, the dealer replaced the right control arm and both rear dampers a second time.

Our Cooper S made 11 visits to the dealer for maintenance or repairs during the duration of its stay, yet even that lofty number does not capture just how much time it spent in the dealer's care. Parts were rarely in stock at our dealership, let alone in the U.S., so they were often ordered and shipped in all the way from Germany, seemingly by rowboat. In one 90-day stretch, our Cooper S spent 45 days in our dealer's possession.

We enjoyed a break when the odometer rolled from 18,000 to 28,000 miles without a single trip to the dealer.

But, with just 600 miles left in its stay, the creaks from the front end and the clatter from the rear returned. We began to suspect that the suspension components were just as weary of the Mini's punishing ride as were our drivers. There's more initial compliance in this Mini than in prior models, but anything more severe than a perfectly aligned expansion joint still has the potential to crash into the cabin. The \$500 adaptive dampers do nothing to soften the plodding of the \$500 18-inch



▼ C/D TEST RESULTS

	NEW	40,000
PERFORMANCE		
ZERO TO 60 MPH	6.6 sec	6.4 sec
ZERO TO 100 MPH	17.5 sec	17.0 sec
ZERO TO 130 MPH	37.0 sec	38.7 sec
ROLLING START, 5-60 MPH	7.1 sec	7.0 sec
1/4-MILE	15.1 sec @ 94 mph	15.0 sec @ 94 mph
BRAKING, 70-0 MPH	172 ft	166 ft
ROADHOLDING, 300-FT-DIA SKIDPAD	0.91 g	0.88 g
TOP SPEED (DRAG-LIMITED)		144 mph
EPA FUEL ECONOMY, CITY/HWY		24/34 mpg
C/D-OBSERVED FUEL ECONOMY		30 mpg
UNSCHEDULED OIL ADDITIONS		0 qt

OPERATING COSTS (FOR 40,000 MILES)

SERVICE (4 SCHEDULED, 7 UNSCHEDULED)	\$79
NORMAL WEAR	\$0
REPAIR	\$0
GASOLINE (@ \$2.98 PER GALLON)	\$3973

DAMAGE AND DESTRUCTION

REPLACE TWO DAMAGED TIRES	\$467
---------------------------	-------

LIFE EXPECTANCIES (ESTIMATED FROM 40,000-MILE TEST)

TIRES	60,000 miles
FRONT BRAKE PADS	95,000 miles
REAR BRAKE PADS	85,000 miles

WHAT BITS AND PIECES COST

HEADLAMP	\$1097
ENGINE AIR FILTER	\$40
OIL FILTER	\$15
WHEEL	\$323
TIRE	\$241
WIPER BLADES (FRONT PAIR/REAR)	\$39/\$15
FRONT BRAKE PADS	\$140

RANTS AND RAVES

JENNIFER HARRINGTON

The armrest is incredibly awkward. It's too high to comfortably rest your arm, and if you flip it up, your elbow hits it while shifting.

TONY QUIROGA

The clutch and shifter feel are near perfect. It's easy to drive smoothly and a joy to upshift. Even in traffic I'm not bored.

MIKE SUTTON

Sounds and feels as if it's rattling itself apart, just like all the Minis we've had for any amount of time.

JULI BURKE

The engine provides plenty of torque for merging and passing in any gear.

JEFF SABATINI

Everything seems unnecessarily cheap in the interior but designed to trick you into thinking it's premium. This is what cars would be like if we let tweens run the world.

TONY SWAN

No expansion joint, lump, or dime-size bump is too small for the Mini to ignore.

ALEX STOKLOSA

While jonesing for a better look at the broken lumbar knob that was being stored in the rear cupholder, the rear-seat-access lever broke off in my hand. Is this a joke?

DON SHERMAN

If this car were a Christmas present, I would instantly regift it.

AARON ROBINSON

Carried the in-laws around in the back, and they swore up and down that they were comfortable. I think they were just being polite.

DAVID BEARD

The tires ruin this car. They do not play nicely with the unforgiving suspension.

. *long-term test*

wheels, which are wrapped in stiff, run-flat tires. The unforgiving suspension may enable the Mini's snappy steering responses and flat handling, but it also makes this 2839-pounder stomp down the road like a heavyweight.

As our pity turned to disdain, we felt a pang of sympathy for the technicians. They must have been as confounded by the Mini as we were. Once again they set about replacing the front control arms—they had since been redesigned, we were told—and the rear dampers. By now, though, the bolts that held it all together had been removed and torqued eight times. The Mini earned another extended stay when a captive nut that mounts the control arm to the body stripped. The dealer briefly mulled disassembling the interior to weld on a new nut, but the home office ultimately advised them to drill out the bad threads and insert a Heli-Coil (a pre-threaded tube). We can only report that the whole job held up for at least 600 miles.

If there's one unquestionably positive trait to the Cooper S, it's the enthusiastic turbocharged 2.0-liter four-cylinder, which is a member of BMW's new modular-engine family. Its 189 peak horsepower and 207 pound-feet of torque are delivered in any gear without any discernible lag. The

tall stick of the six-speed manual slides through longish throws with lovely weight and feel, and the progressive clutch pedal operates with a natural ease. The Cooper S's torquey pep around town translated to a 6.6-second run to 60 mph during the Mini's initial test. That figure dropped to 6.4 seconds with 40,000 miles on the odometer. We were also impressed that we beat the EPA combined-fuel-economy rating by 2 with an average of 30 mpg.

The least troublesome aspect of our Cooper S wasn't problem-free, though. Shortly after its first oil change at just more than 10,000 miles, the Mini began marking its territory, leaving small, greasy spots wherever we parked it. To fix the leak, the oil-filter housing was replaced under a recall that the dealer failed to perform during our visit six days earlier. And one driver experienced a momentary surge followed by a loss of power while merging onto a highway. The car entered a limp mode that disappeared only after sitting for an hour. We never found the cause.

Most disappointing of all, this kind of aggravating Mini experience isn't a new one for us. It's an echo of the quality we witnessed during long-term tests of a 2009 John Cooper Works Convertible and a 2011 Cooper S Countryman. This story should be a discussion of the Mini's rough ride, its animated engine, the inflated price, and its spry handling. But we can't write that story because, for 21 months, we were antagonized by maddening noises and the accompanying headaches. Despite that, there's still some lemonade to be made: Our 2014 Mini Cooper S never left anyone stranded. ■

↓ Adorable children make everything seem better. The Mini Cooper's cargo area can accommodate three such lemonade makers.



★ FLEET FILES



▲ 2016 HONDA PILOT ELITE

9501 MILES

21 OBSERVED MPG

The Pilot, former butch SUV wannabe, now presents as a softer form that hints at the minivan within. We ordered ours in fully bedazzled Elite trim, which includes navigation, Blu-ray rear-seat entertainment, a two-row sunroof, and heated and cooled front seats (plus heated captain's chairs in the second row). Elite models also get the Honda Sensing package, which adds adaptive cruise control, automatic braking, and lane-keeping assist. It all adds up to a \$48,000 Honda. Seven-passenger seating and a quiet highway demeanor mean that the miles are adding up fast, too.



▲ 2015 TESLA MODEL S P85D

21,586 MILES

67 OBSERVED MPG_e

Winter's frigid weather regularly reduced our Model S's power, regenerative-braking ability, and range. While the cold never stopped us from driving the Tesla, it did keep us closer to home. One driver reported that a 130-mile drive sapped 190 miles from the car's 220-mile range. The lazy touchscreen is even more sluggish in subzero temps and doesn't respond at all to gloved fingers. The good news is that the rejuvenating forces of spring appear to be figuratively recharging the Tesla's batteries. On warmer days, our Model S is once again offering its full abilities.



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• HATCHBACK

2017 CADILLAC XT5

Not your grandpa's float boat. *by Don Sherman*

■ The knocks come hard and fast in the car biz. Case in point: Cadillac. Customers have reacted to the billions invested in two sports sedans and one coupe with an unwavering taste for the old-school Escalade, SRX, and XTS models. Demonstrating admirable resolve, Cadillac hasn't slackened its attack on luxury imports, bringing forth cars such as the V models, the full-size CT6 sedan, and now the XT5, the two-row crossover presented here, which will directly challenge the established German and Japanese players.

Most important, from behind the wheel, the XT5 has the dexterity to convince import defectors that they made a wise move. While Cadillac doesn't claim to be hunting Porsche Macans, it's clear that driving enthusiasts tuned the XT5's chassis. The electrically assisted steering is keen to respond and firm in effort. The ZF-Sachs Continuous Damping Control shocks and meaty anti-roll bars practically eliminate ride harshness and lean.

Optional 20-inch wheels wrapped with Michelins deliver crisp turn-in and tight grip. The base 18-inch all-season

Michelins, which combine the same 235-mm section width with a taller sidewall, yield a plusher ride, slightly lazier steering response, and hints of body float, in large part because the adaptive dampers don't come with this rubber.

Lugging 4000 to 4300 pounds plus occupants, the XT5's 310-hp V-6 has its work cut out. Running through eight gears to cruising speed and beyond is no issue, but when you nudge the gas to pass, the initial impression is one of nobody home under the hood. The combination of the transmission's 0.67:1 top gear and a 5000-rpm torque peak means you must drop a few ratios to trigger suitable surge. To use the paddle shifters, which are stealthily hidden behind the steering-wheel spokes, you must first enable their operation by bumping the console shifter

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▼ SPECIFICATIONS

VEHICLE TYPE:	front-engine, front- or 4-wheel-drive, 5-passenger, 4-door hatchback
BASE PRICE	 \$39,990-\$48,385
ENGINE TYPE:	DOHC 24-valve V-6, aluminum block and heads, direct fuel injection
DISPLACEMENT	 223 cu in, 3649 cc
POWER	 310 hp @ 6700 rpm
TORQUE	 271 lb-ft @ 5000 rpm
TRANSMISSION:	8-speed automatic with manual shifting mode
DIMENSIONS	
WHEELBASE	 112.5 in
LENGTH	 189.5 in
WIDTH	 75.0 in
HEIGHT	 66.0 in
PASSENGER VOLUME	 105 cu ft
CARGO VOLUME	 30 cu ft
CURB WEIGHT	 4000-4300 lb
PERFORMANCE (C/D EST)	
ZERO TO 60 MPH	 6.7-6.9 sec
ZERO TO 100 MPH	 19.3-19.5 sec
1/4-MILE	 15.4-15.6 sec
TOP SPEED	 130 mph
FUEL ECONOMY	
EPA CITY/HWY	 18-19/26-27 mpg

an extra notch from D to M mode. Engaging the sport mode with a console button also changes up- and downshift actions for the better. The good news is that this V-6 revs blissfully and eagerly over 7000 rpm.

The XT5's 3.6-liter V-6 is a fresh design that's smoother, slightly more potent, and more efficient than the previous 3.6, thanks in large part to new cylinder-shutdown and stop-start programming. The EPA-combined fuel-economy ratings top the outgoing SRX's by more than 15 percent.

An eight-speed automatic is standard with either front- or four-wheel drive. In four-wheel-drive models, a clutch disconnects the propshaft to the rear when maximum traction isn't needed. Two more clutches in the rear differential can route up to 1100 pound-feet of torque (thanks to gearing multiplication) to each half-shaft on cue. A control computer commands engagement with heavy doses of throttle and also when front slippage is detected. The goal is sure-footedness on sloppy road surfaces, not tail-sliding antics à la the new Ford Focus RS, which also uses a version of this GKN Twister AWD system.

The new XT5 holds to the SRX's exterior dimensions while shedding 300 pounds and enlarging the space inside.

↑ Any hints of cheapness in the XT5's interior are well hidden. And thanks to narrow pillars, forward visibility is excellent.

Cadillac designers gave the XT5 broad-shouldered proportions, a conspicuous grille, and prominent hood and side-surface creases. To aid visibility, the roof pillars are as narrow as possible, the mirrors attach to the doors, and there are quarter-windows near the base of the windshield. An optional video feed to the inside mirror triples the rear view provided by a conventional unit.

The XT5 rolls on GM's new C1XX, or Chi, architecture, which it will share with the new 2017 GMC Acadia. While GMC added four inches of length to continue three-row seating inside its Acadia, Cadillac used the two-inch gain over the SRX's 110.5-inch wheelbase to stretch rear-seat legroom by 3.2 inches.

Saving mass is SOP these days, but Cadillac did so without costly materials. The XT5's unibody is made of steel, but its curb weight sneaks below every direct competitor's.

The XT5's interior is redolent of a shoe factory thanks to stitched leather gracing the dash, console, door panels, and seats. Surfaces that look like suede, wood, aluminum, carbon fiber, or leather are actually

made of that stuff. The same can be said of the hard-plastic panels, which are thankfully few in number and located below knee level. The move to an electronic shifter opened up space in the console's basement for your tablet. In addition to the usual power and USB outlets, a wireless phone charger is standard. An improved CUE infotainment

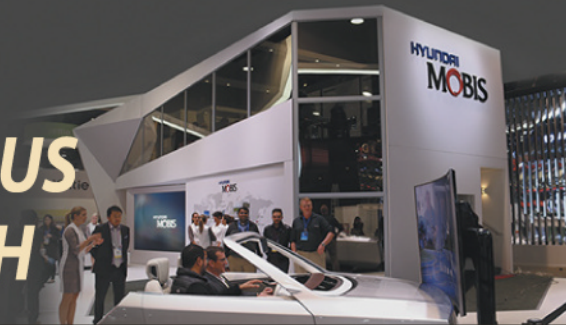
array offers improved screen graphics with both Android Auto and Apple CarPlay connectivity.

Cadillac's best interior work is the XT5's versatile back seat. This chair-high perch splits in 40/20/40 sections and folds nearly flat to provide 63 cubic feet of load space, on par with a BMW X3. The rear seat slides fore-and-aft 5.5 inches, and its backrest tilts 12 degrees in five steps. Long back doors and a hatch you can open automatically by swinging a foot under the rear bumper provide easy access.

XT5 prices start at \$39,990 and crest at \$65,835 for a four-wheel-drive Platinum edition with the optional driver-assist package (adaptive cruise control, automatic emergency braking, and park assist). To sow Cadillac spirit throughout the luxury-crossover segment, there are four trim levels and a wealth of equipment alternatives.

Now that we've hammered the XT5 on entertaining roads, the next step is testing its prowess to see exactly how well this challenger stacks up against the Porsche Macan and BMW X3 class leaders. But *nota bene*: This isn't just a reskinned version of the last, soft SRX; it's a driver-focused luxury crossover in the mold of the Germans and, well, the first SRX.

HYUNDAI MOBIS OPENS A NEW ERA OF AUTONOMOUS DRIVING WITH ITS DAS TECH



- In January, Hyundai Mobis introduced advanced autonomous driving technologies including DAS (Driver Assistance System) at CES.
- In 2014, it already succeeded in demonstrating its autonomous driving and driverless parking system.
- Repeatedly conducting road tests to refine accuracy of the control and the position determination and while enhancing cognitive ability of the system

As soon as the driver inputs the destination, the vehicle begins to search for a 5G communication network. The vehicle senses the driving environment and updates with the optimal route in real time through continuous V2X. As the vehicle operates autonomously, passengers are able to conduct a video conference on the front display while on the move, review data and take care of a backlog of work, catch up on sleep or watch a video.

Introducing various DAS technologies and autonomous driving technologies at CES

What is described above is part of the simulation of autonomous driving introduced by Hyundai Mobis at the Consumer Electronics Show (CES), held in January at Las Vegas, US. At the show, Hyundai Mobis attracted global attention with its innovative future technology such as advanced Driver Assistance System (DAS) and intelligent cockpit system which are the stepping stone technologies to realizing fully autonomous vehicles.

Hyundai Mobis opted to showcase autonomous driving technologies at a CES, not necessarily a motor show, because the boundaries between the automotive industry and the IT industry are beginning to blur and technologies are being integrated at an accelerated pace.

In fact, experts predict that partially autonomous driving vehicles will be running on the roads as of 2020, and fully autonomous vehicles will begin to surface around 2025. As a result, many automotive makers and IT companies are working hard to develop autonomous driving vehicles and a few companies are already starting to show some results, e.g. successfully driving them on general roads.

Hyundai Mobis, a global automotive parts maker, is also striving to further develop autonomous driving technologies, as can be seen by the company having successfully demonstrated ▲ pedestrian recognition ▲ front vehicle overtaking ▲ autonomous braking, acceleration, and deceleration, and remote valet parking function in front of media in 2014.

Securing autonomous driving technologies through huge R&D investments

Hyundai Mobis is concentrating its research resources towards securing autonomous vehicle technologies in the belief that competitiveness in this segment represents the future of the company. To this end, the

company invested USD50 million back in 2013 to construct a new research building which exclusively conducts research on electronic auto-parts, and has also hired a large number of researchers.

Through such investments, Hyundai Mobis is aiming to introduce its autonomous driving technology on the roads by 2020. The company is confident in competing against overseas leaders at the equal level in the global future car market.

More specifically, Hyundai Mobis is accelerating its pace in refining the Driving Assistance System (DAS) technology, the precondition for autonomous vehicles. The essence of DAS technology is that the sensors are to recognize the situation, while the ECU ascertains the information of the situation and controls mechanical devices. It is not very different than some of the basic principles of autonomous driving technology. Accordingly, as DAS technology can accelerate the development of autonomous vehicles, many companies are eager to secure advanced DAS technologies.

Hyundai Mobis has brought up its DAS technology level similar to that of global leading parts makers and therefore the company is expected to attain a competitive edge in the autonomous driving market.

The technologies Hyundai Mobis has already introduced include Advanced Smart Cruise Control (ASCC), Lane Departure Warning System and



Lane Keeping Assistance System (LDWS & LKAS), Advanced Emergency Braking system (AEB), Smart Parking Assist System (SPAS) and Blind Spot Detection system (BSD), all of which are currently being supplied to OEMs.

In addition, Hyundai Mobis is now capitalizing on its DAS technical know-how to conduct research on integrating separate individual systems. It is also endeavoring to improve more precise and accurate control of the system while enhancing its cognitive ability and position determination.

Hyundai Mobis is putting arduous efforts to stabilize and perfect the autonomous technologies to be safe enough to transport people. To this end, it is repeatedly engaged in road testing at its 4 different test sites around the world.



2017 MASERATI LEVANTE

A pretty, big gust blows out of Italy. *by Aaron Robinson*



Sometime over the last couple of decades, every luxury brand decided it needed an SUV to remain relevant in a market gone bonkers for tall wagonoids. Well, almost every one; Ferrari still hasn't committed to any truck that we know of, though it would almost certainly be, as The Donald says, *Yuge!* That's because buyers have shown no squeamish-

ness toward SUVs from traditional luxury and sporting brands, and the only real trick is translating an exotic label's core values into a four-door, hunchbacked mall finder.

Maserati unabashedly declares victory in that effort by calling its new Levante "the Maserati of SUVs." And now that we've pounded some of northern Italy's pavement in what is likely to be the closest thing to a Ferrari off-roader that we'll ever get, we're buying the sales pitch. The gleaming trident has been thrust into the truck genre in a way that stays true to the Modenese boutique's strongest selling points. Taking the Ghibli sedan for its guts, the Levante both improves on that vehicle and offers a unique character that is distinct from every SUV that has preceded it.

It's best to think of the Levante, named for a wind in the western Mediterranean,

▼ SPECIFICATIONS

VEHICLE TYPE: front-engine, 4-wheel-drive, 5-passenger, 4-door hatchback

BASE PRICE (est) \$74,000-\$85,000

ENGINE TYPE: twin-turbocharged and intercooled DOHC 24-valve V-6, aluminum block and heads, direct fuel injection

DISPLACEMENT 182 cu in, 2979 cc

POWER 345 or 424 hp @ 5750 rpm

TORQUE 369 or 428 lb-ft @ 1750 rpm

TRANSMISSION: 8-speed automatic with manual shifting mode

DIMENSIONS

WHEELBASE 118.3 in

LENGTH 197.0 in

WIDTH 77.5 in

HEIGHT 66.1 in

PASSENGER VOLUME 112 cu ft

CARGO VOLUME 19 cu ft

CURB WEIGHT 4650 lb

PERFORMANCE (C/D EST)

ZERO TO 60 MPH 5.0-5.8 sec

ZERO TO 100 MPH 12.3-13.6 sec

1/4-MILE 13.8-15.0 sec

TOP SPEED 156-164 mph

FUEL ECONOMY (C/D EST)

EPA CITY/HWY 15/19 mpg

as a Ghibli wagon in the mold of the Audi Allroad. That means it's primarily an on-pavement, all-weather fast hauler with just enough four-wheel-drive capability and driver-selectable ride-height range to give the thing some decent trail abilities. As with the current crop of Maseratis, the Levante is fast, ferociously loud when it needs to be, and handles the bejesus out of a corner, but it's even better than the car that underpins it. Call it Ghibli 2.0.

The Levante runs the Ghibli's relatively small but fiery 3.0-liter twin-turbo V-6 with two horsepower ratings to choose from: 345 in the circa-\$74,000 base model and 424 in the roughly \$85,000 S (final des-





pension, the Levante runs aluminum control arms up front and five links per corner in back with standard air springs atop the electronically controlled dampers that Maserati brands “Skyhook.” The changes include a longer suspension stroke than the Ghibli’s and five ride-height settings with two off-road positions that raise the ground clearance a maximum 1.6 inches.

Only about 1 percent of owners are expected to ever go off-road, says Maserati, and most are in Dubai where rich yahoos like to take their luxe SUVs out to the Empty Quarter to play in the dunes. But all SUV owners like the fact that their vehicle can do it. Hence, the Levante also comes standard with Q4, Maserati’s rear-biased, permanent four-wheel drive. At FCA’s old Balocco test track, we were pointed down a trail through the woods that included some fairly serious obstacles. Between the extra ground-clearance modes, the seamless forward torque transfer, the limited-slip rear diff, and some surprisingly generous ramp angles, the Levante acquitted itself as a decent mud puppy.

On the road, the suspension is more compliant than we expected, especially on the S’s optional 20-inch rims that wear giant 295/40 Pirelli P Zeros in back. You can firm it up with a sport setting, but the thinking at Maserati, highly laudable in our view, is that SUV buyers want a bit more daily comfort. Still, the Levante is a pretty tense machine, with an engine that is just waiting to leap to 4000 rpm at the slightest provocation. This ain’t no Lexus—and a hearty *salute* to that.

Leather and French stitching swaddle the interior. Maserati finally gets a control knob for the center touchscreen. It’s not quite as polished as Audi’s MMI, as the Maserati’s control knob is simply grafted onto the old system, which was intended to be touchscreen only, but we give FCA credit for finally recognizing the appeal of this feature. An optional Zegna Edition luxury package incorporates interior appointments from the famous Italian clothier, including silk seat inserts and “silk jersey” on the doors and headliner that your fingers will love petting. The option pricing, when announced, will easily loft the sticker above \$100,000.

With the Levante, FCA is taking a risk, giving the SUV a dedicated production facility at its Mirafiori plant near Turin and counting on it for 30,000 sales per year globally. But it’s greatly helped its cause by doing the product right.

tinuation charges haven’t been announced). The latter is a 20-hp increase over the Ghibli S’s output due to changes to the Levante’s intake and exhaust, and the factory puts the 60-mph sprint at 5.0 seconds (5.8 seconds for the 345-hp model). There’s also a 3.0-liter diesel, but we won’t weep that it’s not coming to the U.S. Our short turn in it showed the diesel version to be a Maserati with its heart cut out.

Meanwhile, the throttle response of the gas V-6 has been greatly improved over the all-or-nothing Ghibli’s. The engineers retuned the electronic throttle to respond more vigorously at lower speeds, the eight-speed ZF automatic quickly downshifting to pitch the revs up into a fatter torque range. Fuel economy takes it on the chin, but the Levante S we drove was never caught flat-footed, and it surged with a thrilling lupine bark from its quad pipes.

That deep, esophageal snarl, so distinctly Italian, never gets old and is one thing that separates the Levante from its direct German competition, including the

↑ How divorced are SUVs from their origins? The Levante is offered with a Zegna Edition package that includes silk inserts for the seats.

Audi Q7, BMW X5, and Porsche Cayenne. Another thing is the steering. Maserati sticks with hydraulic boosting in a world gone largely electric, which helps give the big three-spoke steering wheel an organic alertness. It tugs and sags over rolling pavement in a vintage way that is now largely lost (or, at least, imperfectly simulated) in the wider industry. Nothing imparts a sense of control more than a direct connection to the front tires, and, with good visibility to the front corners, the big Levante is an easy car to place precisely in a turn. If the driver can confidently clip a curb with inches to spare in a car that is more than 16 feet long, weighs around 4650 pounds, and tows 6000 pounds, then Maserati has done its job.

Using an evolution of the Ghibli’s sus-



2017 CHRYSLER PACIFICA

Best for breeders.

by John Pearley Huffman

Minivans have reached their 21st-century cultural inflection point. If vans are going to remain relevant, they must find new customers by fighting off their procreative stigma. Or, conversely, their makers should be doubling-, tripling-, or quadrupling-down on family friendliness and betting on a sustainable uptick in the fertility rate. Chrysler isn't taking any chances with the 2017 Pacifica; it's trying both approaches.

So Chrysler is all-in on the perpetuation of two species: human and minivan. It's a leap of faith; a rebranded jump that a better-riding, better-looking, more powerful, gadget-encrusted box will be attractive to today's buyers. Stuff to increase the van bandwidth—the “vanwidth” to swipe a phrase. And getting out of the van game altogether would have left Chrysler's deal-



ers with only the 200 and 300 sedans to peddle. Thin gruel.

The Pacifica replaces the Town & Country, the only vehicle in production with an ampersand in its name. The Dodge Grand Caravan is being allowed to linger a few more months before dying as part of a reorientation of the brand toward performance vehicles. With a production history stretching back five generations to 1983, the Caravan was, along with the Plymouth Voyager, the first contemporary

↑ With plenty of swooping lines and gleaming chrome jewelry, the Pacifica's instrument panel mimics the van's exterior design.

front-drive minivan. It is also Dodge's longest-lived, continuously produced model.

Why did Chrysler disinter the Pacifica name for the new van? Well, that name was the most memorable thing about the bland crossover that wore it for the 2004 through 2008 model years. So, why not?

The Pacifica is optimized for that life stage between discovering a baby is on the



▼ SPECIFICATIONS

VEHICLE TYPE:	front-engine, front-wheel-drive, 7- or 8-passenger, 4-door van
BASE PRICE	 \$29,590-\$43,490
ENGINE TYPE:	DOHC 24-valve V-6, aluminum block and heads, port fuel injection
DISPLACEMENT	 220 cu in, 3605 cc
POWER	 287 hp @ 6400 rpm
TORQUE	 262 lb-ft @ 4000 rpm
TRANSMISSION:	9-speed automatic
DIMENSIONS	
WHEELBASE	 121.6 in
LENGTH	 203.6 in
WIDTH	 79.6 in
HEIGHT	 70.0 in
PASSENGER VOLUME	 165 cu ft
CARGO VOLUME	 32 cu ft
CURB WEIGHT	 4350 lb
PERFORMANCE (C/D EST)	
ZERO TO 60 MPH	 7.2 sec
ZERO TO 100 MPH	 21.5 sec
1/4-MILE	 15.6 sec
TOP SPEED	 120 mph
FUEL ECONOMY	
EPA CITY/HWY	 18/28 mpg

← Inside this tasty, curvaceous loaf are all the comforts of home, including an entertainment system and back-talking kids.

along the bottom edge of the rearmost side windows. It looks cleaner than the channels that run along the sides of competitors. There are a few other elegant touches, such as the large side mirrors atop long pedestals and an available “tri-pane” sunroof that stretches to cover nearly all the cabin. By the way, though the structure is mostly steel, the sliding doors are now aluminum.

While there’s nothing revolutionary about the Pacifica’s structure, it is an all-new platform. Of course, the familiar 3.6-liter Pentastar V-6 rides transversely in the nose, and MacPherson struts hold that nose high. Naturally, the rack-and-pinion steering is electrically assisted. The rear suspension has what Chrysler calls “blade configured” (a deliciously precious way of saying stamped steel) trailing arms, each of which uses a pair of main bushings with different attributes: one to better manage lateral loads and the other to handle fore and aft loads.

Thanks to a conscientious weight-reduction program, including the more extensive use of aluminum in strategic places—such as the suspension links—the Pacifica comes in about 250 pounds lighter

way and seeing your child grown up enough to develop a smart mouth and win the occasional logical argument. It’s the time when the kids aren’t ashamed to be seen with their parents, when they expect to be shuttled to activities that have been chosen for them, and when they haven’t yet been narcotized by personal electronics. Once that childhood moment passes, though, a minivan is the last thing they want to be seen in.

“Ugh, it’s a mom mobile,” my 15-year-old daughter, Nina, said upon seeing the Pacifica for the first time. “I’m so embarrassed.” Her reaction in mind, I approached my son, Jack, who is 14, from a different tack. “It has an HDMI port,” I told him. “Does it have a power supply?” he asked while grabbing his PlayStation 4 and disconnecting it from the TV. “Yes,” I said, and fortunately it did.

To stave off the moment the stigma kicks in, Chrysler overdosed on styling flourish. The excess mostly works, the Pacifica being one of the best-looking van bodies ever plopped atop four wheels. Building on current Chrysler styling themes, it’s a heavily sculpted steel structure with character lines that swoop, soar, and droop with the reckless abandon of a 10-year-old using a French curve for the first time. Despite the riot of lines, it looks particularly good in profile, with the tail tapering back to a rear window with a simulated wraparound effect. It’s Gauguin to the old Town & Country’s Bauhaus.

One design element the Pacifica retains from the previous Chrysler minivans is a sliding-door track hidden





↑ Can we all just finally acknowledge that a box on wheels is a better way to carry people and cargo than a crossover? No? Okay.

than a comparable Town & Country. It's still big, with a 121.6-inch wheelbase that's 0.4 inch longer than the T&C and an overall length of 203.6 inches, down 0.1 inch. It's 0.7 inch longer than a Honda Odyssey.

While a new gas-electric hybrid will arrive in a few months, at launch the only engine is the Pentastar V-6 rated at 287 horsepower and 18 mpg city/28 highway, which is better than the T&C but slightly thirstier than the segment-leading Odyssey at 19 city/28 highway. Lashed to Chrysler's ubiquitous TorqueFlite nine-speed automatic transaxle, the engine feels understressed in most situations. There's some disconcerting gear hunting as the transmission strives to keep engine speeds down (sixth through ninth gears are overdrives), but mostly what the powertrain produces is the pleasant sensation of competence, even if sometimes that means dropping six gears to find the right ratio to get around a slow-moving Bimbo Bakery delivery truck.

After all, this is a van that weighs a claimed 4350 pounds. That weight is felt in how the steering numbly reacts to input and how the standard 235/65R-17 front tires push through corners. If there's a sporting bone in this van, it's likely one your dog dragged into it. The top-of-the-line Limited model can also be shod with 18s or 245/50 tires on 20-inch wheels. Quick is a relative term, but the Pacifica seems likely to be the hot rod of its class. The last Odyssey that *C/D* tested made its

way from zero to 60 mph in 7.7 seconds. The Pacifica, with a bit more power, is likely to better that by half a second.

Amazingly, among the blizzard of new tech and safety equipment the Pacifica brings, the most impressive widget is still Chrysler's super-clever Stow 'n Go second-row seats, which drop into the floor to extend the cargo capacity. Yeah, the new 8.4-inch touchscreen in the super-swoopy dash is impressive, but these screens are pretty ordinary now. Meanwhile those drop-down seats remain Chrysler's alone. They are now complemented by an onboard vacuum that's mounted midships so that it can reach

↓ Chrysler's familiar Stow 'n Go second-row seats, which fold into cavities in the floor, remain one of the great minivan innovations.

dropped Cheetos in every distant corner.

With my son mesmerized by his PlayStation and my daughter absorbed in Snapchat, the minivan form still offers superior utility, comfort, and space to any crossover. And at this point, the minivan-driving experience is virtually indistinguishable from that of a larger crossover. If your kids are in the right age group, it's ludicrous to deny the attraction of a vehicle like the Pacifica.

But my kids? They are too old, and any appreciation for the practical advantages of a minivan is simply beyond them. So is a sense of gratitude, but that's another story.





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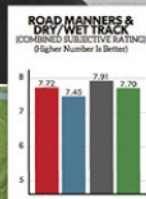
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LAMBORGHINI HURACÁN LP610-4 SPYDER

All of the bull, none of the roof. *by K.C. Colwell*

Since the VW Group's 1998 takeover of Lamborghini, the tiny Italian village of Sant'Agata Bolognese, population 7300, has exploded. The Lamborghini factory nearly tripled its head count since 2000, to 1200 workers, and in the same time increased sales from 296 cars to 3245, the total for 2015. In 19 months, the new Huracán's sales were up 69 percent over what Lamborghini's most successful car, the Gallardo, managed in the same time. This new Huracán Spyder shouldn't let the Santagatesi down.

Chopping the top off the atomic wedge didn't require extra bracing for its aluminum and carbon-fiber spaceframe because the car was designed from the beginning with open-roof aspirations. Lamborghini says stripping the top reduced torsional rigidity by 10 percent, though detecting that reduction is all but impossible because 90 percent of incredibly stiff is still pretty dang stiff. There was no hint of cowl quiver in our drive around a rainy Miami.

When the rain paused for a few minutes, it gave us time to analyze the top's operation, which takes 17 seconds to either



↑ The Spyder maintains the extreme wedge shape of the coupe. Lamborghini offers interior trim the color of cartoon plutonium.

retract or deploy. Designers worked overtime to maintain the car's silhouette with the top down. And thanks to an intricate convertible boot that mimics the coupe's B-pillars, they were largely successful.

The top adds 265 pounds to a base Huracán's weight, bringing it to 3650 pounds. Two fabric-skinned ears that extend to the outside of each headrest add a small bit to that mass. Their mission is to keep gust turbulence to a minimum, and the tabs do their job well; it's easy to hear conversations at 70 mph. Aside from the extra mass—so what if your four-wheel-drive Spyder can only manage a zero-to-60-mph run in 2.8 seconds versus the coupe's 2.5—reduced rearward visibility is

▼ SPECIFICATIONS

VEHICLE TYPE: mid-engine, 4-wheel-drive, 2-passenger, 2-door convertible

BASE PRICE \$267,545

ENGINE TYPE: DOHC 40-valve V-10, aluminum block and heads, port and direct fuel injection

DISPLACEMENT 318 cu in, 5204 cc

POWER 602 hp @ 8250 rpm

TORQUE 413 lb-ft @ 6500 rpm

TRANSMISSION: 7-speed dual-clutch automatic with manual shifting mode

DIMENSIONS

WHEELBASE 103.1 in

LENGTH 175.6 in

WIDTH 75.7 in

HEIGHT 46.5 in

CURB WEIGHT 3650 lb

PERFORMANCE (C/D EST)

ZERO TO 60 MPH 2.8 sec

ZERO TO 100 MPH 5.9 sec

1/4-MILE 10.6 sec

TOP SPEED 201 mph

FUEL ECONOMY

EPA CITY/HWY 14/21 mpg

the sole downside to Spyder ownership.

Flat-foot the throttle and any wind noise takes a back seat to the 602-hp 5.2-liter V-10's screaming engine note. Shifts from the seven-speed dual-clutch automatic transmission sound off like a brooding Doberman's warning from beyond the chain-link.

Our review is well timed to the theme of this issue, as Lamborghini is in the unique position of offering the only naturally aspirated exotic fleet, and it plans to keep it that way for as long as it can. Turbo-charged engines are inherently more efficient, and Lamborghini knows that it will eventually surrender to regulatory obligations. But until then, Huracán drivers will have to cope with knowing that half of their V-10 shuts off under low loads, saving a bit of juice. It's not enough, however, to eliminate the \$1700 gas-guzzler tax that is part of the car's \$267,545 sticker.

If Miami roads are known for anything, it isn't curves. The graph-paper grid of streets didn't allow us to detect exactly how at-the-limit handling benefits from the \$3400 magnetorheological dampers or the standard 20-inch Pirelli P Zeros. The ride, though, is as supple as that of any 200-mph supercar this side of a hydro-pneumatically augmented McLaren, and all indications are that this car is nearly as capable as the sublime Huracán coupe.

Coming on the heels of the Huracán Spyder is an SUV called the Urus. While this seems to go against brand ethos, Lambo's now former boss Stephan Winkelmann—or *Il Presidente* according to factory letterhead—has said the Urus might sell 3000 a year, which would effectively double Lamborghini sales. That would definitely be a good thing for the local economy in Sant'Agata.

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** Answer: Nope, but V1 owners sure know it's there.

Can you spot the difference?



► ESP added to enable info sharing with auxiliary devices.

2011

Can you spot the difference? **



► Longer range: warning distance increased on Ka-band.

2005

Can you spot the difference?



► Laser warning redesigned to fit within original-height case.

2001

Can you spot the difference?



► New LED display identifies each of four bands: X, K, Ka and laser.

1998

Can you spot the difference?



► Front and rear laser-warning added; requires taller case.

1997

Can you spot the difference?



► V1 debuts with radical new feature—the Radar Locator.

1992

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CHEVROLET COLORADO Z71 CREW CAB 4WD DIESEL

TESTED Increased towing capability, diesel fuel economy. A pricey option limited to upper trims, properly slow, gruff engine sounds. *by Mike Sutton*

With the recent sales momentum of the revised Toyota Tacoma and the new Chevy Colorado/GMC Canyon twins, GM's introduction of diesel power to the mid-size-pickup segment seems like a clever play. But in a market built around established full-size trucks, the advantages of that combination are less than clear.

Built in Thailand and available on 2016 Chevrolet and GMC models, GM's new turbocharged 2.8-liter Duramax four-cylinder is an effective but leisurely workhorse. Although its 181 horsepower is less than the 200 from the standard 2.5-liter gasoline four, its hearty 369 pound-feet of torque surpasses the optional 3.6-liter V-6's by a full 100.

This long-stroke Duramax revs to only

↓ It might not be quick or quiet, but the diesel Colorado delivers better fuel economy and greater towing capacity than the gas versions.

about 3000 rpm in regular use, delivering thrust in quick, punchy surges. The six-speed automatic, the only transmission offered with the diesel, is smooth and shifts quickly to maximize the engine's narrow powerband, despite being down a couple of ratios from what you get in most of GM's larger light-duty trucks.

Compression-ignition engines are built stoutly, and our Colorado crew-cab test truck weighed nearly 300 pounds more than a comparable V-6 model. Most of that gain comes from the Duramax's heavy cast-iron block, as well as a urea-injection system that treats the exhaust to bring the diesel into U.S. regulatory compliance. Our truck needed 9.2 seconds to reach 60 mph, or about the same as a standard four-cylinder version.

On the street, however, the diesel chugs along with less strain than either gas engine and lends as much as an extra 700 pounds of towing capacity for a maximum of 7700. The Duramax also adds a standard trailer-brake controller and exhaust brake, the latter using back pressure in the exhaust to help slow the truck when hauling heavy loads. Fuel economy benefits as well: Our 19-mpg average over 1272 miles included nearly 300 miles of towing a 3400-pound

▼ SPECIFICATIONS

VEHICLE TYPE: front-engine, rear-/4-wheel-drive, 5-passenger, 4-door truck

PRICE AS TESTED \$42,105

BASE PRICE \$39,890

ENGINE TYPE: turbocharged and intercooled DOHC 16-valve diesel inline-4, iron block and aluminum head, direct fuel injection

DISPLACEMENT 169 cu in, 2776 cc

POWER 181 hp @ 3400 rpm

TORQUE 369 lb-ft @ 2000 rpm

TRANSMISSION: 6-speed automatic with manual shifting mode

DIMENSIONS

WHEELBASE 128.3 in

LENGTH 212.7 in

WIDTH 74.3 in

HEIGHT 70.6 in

PASSENGER VOLUME 107 cu ft

CARGO VOLUME 41 cu ft

CURB WEIGHT 4855 lb

▼ C/D TEST RESULTS

ZERO TO 60 MPH 9.2 sec

ZERO TO 90 MPH 23.2 sec

ROLLING START, 5-60 MPH 10.1 sec

1/4-MILE 16.9 sec @ 80 mph

TOP SPEED (governor limited) 99 mph

BRAKING, 70-0 MPH 183 ft

ROADHOLDING,

300-FT-DIA SKIDPAD 0.73 g

FUEL ECONOMY

EPA CITY/HWY 20/29 mpg

C/D OBSERVED 22 mpg

TEST NOTES: The brakes exhibited slight fade over six stops from 70 mph, with distances growing from 183 feet to a maximum of 192.

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enclosed trailer. Unhitched, the truck's frugality climbed to 22 mpg, better than the gas-powered variants we've tested, yet about the same as a larger Ram 1500 4x4 EcoDiesel's.

The Duramax's key identifiers include namesake badges on the Colorado's fenders and a bazooka-like tailpipe. The diesel's clatter is more akin to a mini Peterbilt than a Mercedes-Benz BlueTec, but additional sound insulation prevents most of the noise from penetrating the cabin. Despite a stiffer front suspension, the ride quality remains respectable and the steering responses are commendable.

This diesel's attributes don't come cheap, though, with the Duramax adding \$3905 to our test vehicle. It's only available on crew-cab trucks fitted with the mid-grade LT trim level or higher. With a few extras, our \$42,105 as-tested price was about the same as that of a base V-8-powered Silverado 1500 crew-cab 4x4, which is quicker, more capable, and better to drive.

What's more, the black cloud that Volkswagen spewed over diesel's image in the U.S. will surely follow any new oil-burning powerplant for a while. Given how close these mid-size diesel rigs are to bigger pickups in price and real-world size, most buyers wanting increased capability are better off just buying more truck.





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VOLVO XC90 T8 TWIN-ENGINE PLUG-IN HYBRID

TESTED  Same gorgeous package as the nonhybrid, unique powertrain layout.  Works better on paper than in the real world, pricey. *by Jeff Sabatini*

Success in one endeavor doesn't necessarily predict the same in another. From a statistical perspective, the more times you win, the more inevitable failure becomes. Because except for John Paciorek, who played exactly one game for Houston in 1963, nobody bats a thousand. And the more unrelated the subsequent mission, the greater the chance of stumbling. Such as: turning a three-row crossover into a plug-in hybrid by exchanging its driveshaft and differential for batteries and an electric motor.

To be fair, Volvo doesn't actually convert a finished XC90 into a T8 Twin-Engine Plug-in Hybrid. There is no team of Swedish robots ripping out Haldex hardware to make way for the 9.2-kWh battery pack that gets bolted into the driveshaft tunnel. Volvo's Scalable Product Architecture was designed from the start to accommodate the rear-mounted 87-hp AC motor

that differentiates the T8 from other XC90 models. Volvo calls this version "Twin-Engine" because it retains the 316-hp turbocharged and supercharged four-cylinder that powers the T6. But the T8 in fact has a third power source, a 46-hp electric motor that sits between the gas engine and the XC90's eight-speed automatic transaxle. Total system output is 400 horsepower and 472 pound-feet of torque.

The T8 is so spectacularly complicated that those without an engineering degree might mistake it for a perpetual-motion machine. Any occupant has a right to be confused by its seven drive modes, which make the car more efficient or sportier or optimized for bad weather or off-roading. The self-programmable mode lets you select from 432 combinations, made so by four different powertrain settings, three settings for the optional air suspension (\$1800), three for the steering, three for



↑ Swedish glassmaker Orrefors contributes a crystal shift knob to the XC90 T8's sumptuous interior. Maybe you're into that.

the instrument display, two for the brakes, and two for the climate control.

In electric mode, the T8 operates as a rear-driver, and if you go easy on the accelerator, you can travel up to 13 miles before the gas engine kicks in. At other times, only its front wheels are driven, and selecting the battery-saving mode will force the T8 to use the gas engine to recharge the battery, adding about five miles of electric range. You can also lock it into four-wheel drive or select the power mode, which keeps the rear electric motor engaged and ramps up the gas engine's throttle response.

The lithium-ion battery has its own coolant circuit, while an electric immersion heater warms the other coolant loop to heat the cabin when the T8 is not burning hydrocarbons. Both electric motors are capable of recharging the battery during deceleration or when sending torque to the wheels.

Volvo has managed to package all of this in the same envelope as conventional XC90 models without intruding on the cabin, cargo hold, or third row, or diminishing the 5000-pound towing capacity.

We had high expectations for the T8, coming to it after being thoroughly impressed by the T6. Ultimately, our only complaint with the T6 was our predictable desire for a few more ponies; the hybrid seemed a sure bet to dazzle us with its grunt. And the T8 did deliver better acceleration, hustling to 60 mph in 5.3 seconds compared with six seconds flat in the T6.

The complex powertrain improves straight-line performance, but it also con-



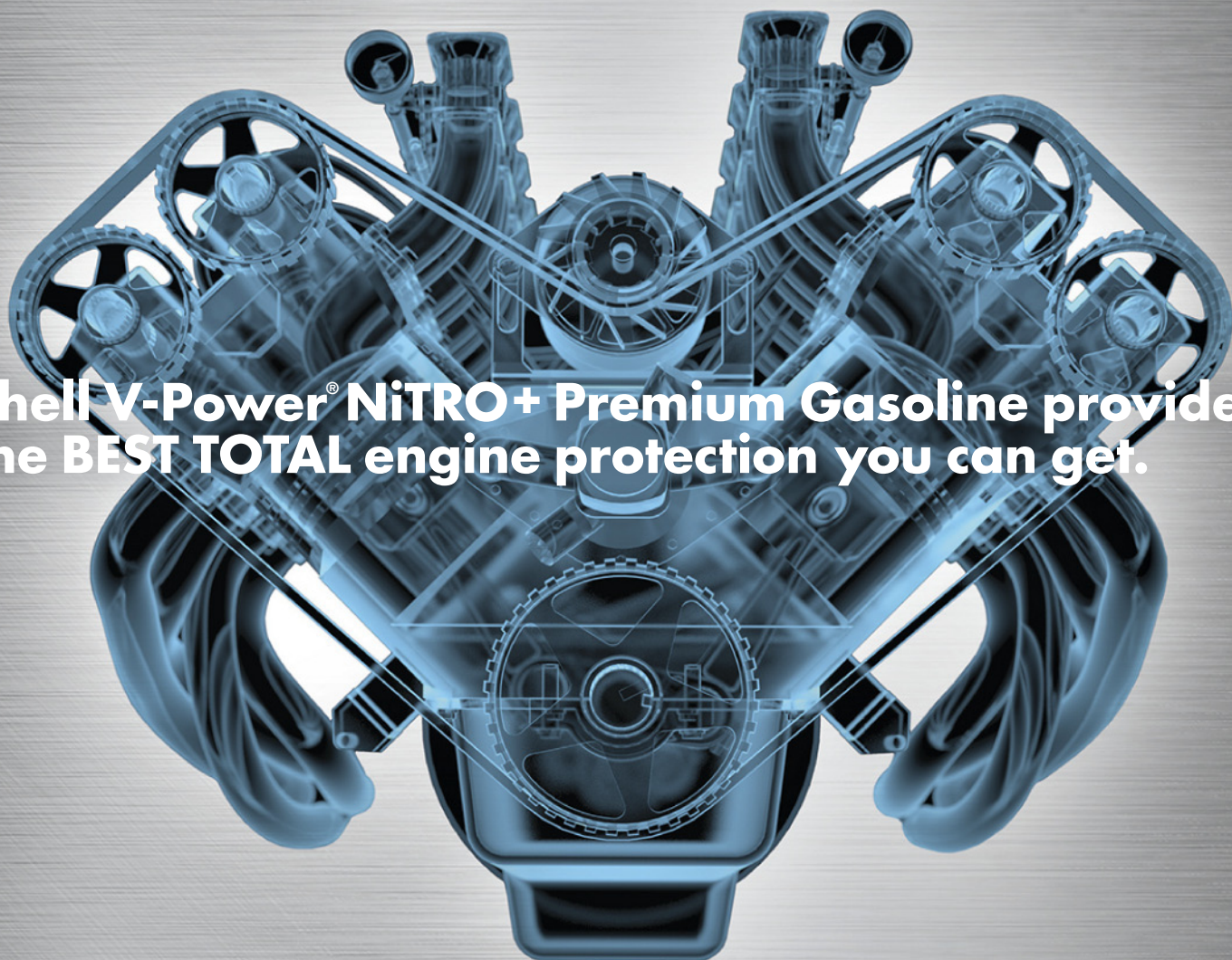
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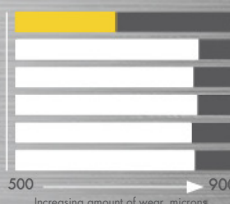
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tributes to the 450-pound increase in the XC90's curb weight. The extra mass saps the relatively lithe feel of the T6. Skidpad performance dropped from 0.84 g in the T6 to 0.81 in the 5159-pound T8, and the braking distance from 70 mph increased from 167 feet to 176. On the road, the XC90 hybrid often felt ponderous, riding heavily over broken pavement.

Occasionally, we detected a lack of coordination between the T8's front and rear drive units. If the gas engine was shut off and conditions were slick, the rear electric motor would get the rear wheels squirrely before the front electric motor, which serves as the starter, could refire the gas engine. Once it did, the front wheels would quickly pull us out of this power-induced oversteer, but not before the XC90 got at least a little sideways. We can't say we didn't enjoy this trick (certainly more than our passenger did), but in other circumstances the lurching power delivery of the decoupled front and rear drive systems was annoying, sloshing coffee and irritating driver and passengers alike.

If we can't call the T8 nimble, at least it's still as fetching as its more affordable XC90 brethren. Volvo's Inscription trim (\$3500) appoints the spacious cabin with natural-looking wood and absolutely gorgeous leather. We did notice an unusually worn driver's seat in our test vehicle, despite the odometer showing only 1500 miles. The optional Bowers & Wilkins audio system (\$2500) delivers stunning clarity and separation, and the XC90's tablet-style user interface is state of the art.



▼ SPECIFICATIONS

VEHICLE TYPE: front-engine, 4-wheel-drive, 7-passenger, 4-door hatchback

PRICE AS TESTED \$84,005

BASE PRICE \$69,095

ENGINE TYPE: turbocharged, supercharged, and intercooled DOHC 16-valve 2.0-liter inline-4, 316 hp, 295 lb-ft; 2 permanent-magnet synchronous AC electric motors;

F: 46 hp, 111 lb-ft; **R:** 87 hp, 177 lb-ft; combined system, 400 hp, 472 lb-ft; 9.2-kWh lithium-ion battery pack

TRANSMISSION: 8-speed automatic with manual shifting mode

DIMENSIONS

WHEELBASE 117.5 in

LENGTH 194.9 in

WIDTH 79.1 in

HEIGHT 69.9 in

PASSENGER VOLUME 131 cu ft

CARGO VOLUME 16 cu ft

CURB WEIGHT 5159 lb

▼ C/D TEST RESULTS

ZERO TO 60 MPH 5.3 sec

ZERO TO 100 MPH 14.6 sec

ZERO TO 130 MPH 35.7 sec

ROLLING START, 5-60 MPH 5.8 sec

1/4-MILE 14.0 sec @ 98 mph

TOP SPEED (governor limited) 132 mph

BRAKING, 70-0 MPH 176 ft

ROADHOLDING, 300-FT-DIA SKIDPAD 0.81 g

FUEL ECONOMY

EPA COMBINED (BATTERY CHARGED/DEPLETED)

CITY/HWY 53 MPGe/25 mpg

C/D OBSERVED 19 MPGe

■ TEST NOTES:

Whether it's in the power, hybrid, or eco-minded pure driving mode, the XC90 T8 gives you all it's got as soon as you mash the right pedal.



Volvo expects buyers to think similarly of the T8's hybrid technology. How else to justify the T8's premium, which starts at \$69,095 compared with \$50,795 for the T6?

The answer is not fuel economy. At 25 mpg combined in hybrid mode, the T8's EPA rating is just three more than the T6's. When running with a charged battery, the XC90 hybrid is rated at 53 mpg-equivalent, and recharging on a 240-volt system takes at

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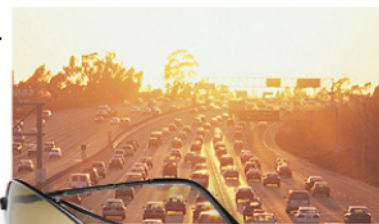
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↑ In our testing, a few hours of charging from a 240-volt source gave the XC90 T8 about 10 miles of electric-only range.

least two and a half hours, depending on the amperage. We managed to deplete the battery of our tester in just 10 miles, even while accelerating as gingerly as possible to keep the gas engine from firing up. Over 800 miles of winter driving that included six charging sessions, our observed fuel economy was a meager 19 MPGe.

But none of these numbers is as significant as that \$18,300 upcharge for the hybrid. Even if the price of 91 octane goes up to \$5 per gallon, the extra outlay for the T8 would be enough to buy 3660 gallons of gas. To save just one gallon, you need to drive through two full battery charges without allowing the gas engine to start. If you could do that every single day, and hit the EPA estimate for combined fuel economy when you're not running on electricity, you wouldn't break even for eight years, assuming 15,000 miles driven annually. Charge only once a day and payback will be extended to more than 13 years. Don't plug in your T8 at all and calculate the numbers with premium gas selling for the \$2.49 per gallon we paid during this test and the financial payoff for going hybrid is so distant that you'd need to factor your XC90 into your estate planning.

Volvo has a star in the XC90, which has been making up more than half of the brand's sales this year. Its success is well earned. But this complex hybrid model is, ultimately, disappointing.

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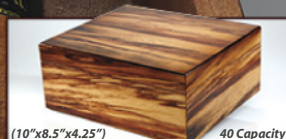
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2017 HYUNDAI ELANTRA LIMITED

TESTED Structurally sound, handsome, efficiently packaged, 31 mpg. Horrendous new-car smell.
by Aaron Robinson

It's hard to think of a car company that is striving as fervently as Hyundai. Each generation of product isn't just a leap; it's an Olympic pole vault. A British consultant living in Seoul once told your author that all Korean engineers do is work, smoke, and occasionally sleep. If so, then their sacrifice is at least not without tangible results.

Take the new Elantra, which addresses our long-standing beef about the structural weakness of Hyundais. The old Elantra was a styling standout as well as a tidily packaged sedan with decent performance. But every bump sent shivers through the body, making it feel cheap and disposable. Hyundai heard our cries and fixed it.

Besides some suspension revisions, the new Elantra uses almost 400 feet of structural adhesive to tightly bind the skeletal stampings, meaning that it feels much more hewn from hardwood than the previous car. Close your eyes (in the passenger seat, please) and the Elantra feels substantial and well-made as it hums along, sipping fuel at an observed 31 mpg.

We found other things to like: The instruments are clustered into a jaunty hooded binnacle that evokes old BMWs; big bins under the armrest and in front of

the shifter recognize the need for clutter parking space but don't compromise the elegant design; at night, the new body's six-eyed-taillight signature will have Syd Mead jotting notes.

Running a 147-hp 2.0-liter four, this is not an overtly sporty vehicle, delivering 0.83 g on a skidpad and huffing and puffing to 60 mph in 8.5 seconds. But it flows with controlled roll from corner to corner and with steering effort that rises and falls commensurate with the angles. A sport/eco button can summon the mildest of sporty shift maps, but you won't notice much difference. Firm brakes, the Elantra's best performance asset, produce a laudable stopping distance of 166 feet.

Like all cars in this densely populated class, from the Toyota Corolla to the Honda Civic to the Chevy Cruze, the Elantra wants to be a mini mid-sizer. Which means buyers can now have most of the amenities of the larger vehicles but without the girth. That includes such formerly fancy equipment as radar cruise control, lane-keeping assist, and swiveling HID headlights. But at \$27,710 as tested, this

↓ The Hyundai Elantra is a sensibly powered, sensibly sized sedan with a sensible interior wrapped in a sensible exterior. Very sensible.

▼ SPECIFICATIONS

VEHICLE TYPE:	front-engine, front-wheel-drive, 5-passenger, 4-door sedan
PRICE AS TESTED	\$27,710
BASE PRICE	\$23,185
ENGINE TYPE:	DOHC 16-valve Atkinson-cycle inline-4, aluminum block and head, port fuel injection
DISPLACEMENT	122 cu in, 1999 cc
POWER	147 hp @ 6200 rpm
TORQUE	132 lb-ft @ 4500 rpm
TRANSMISSION:	6-speed automatic with manual shifting mode
DIMENSIONS	
WHEELBASE	106.3 in
LENGTH	179.9 in
WIDTH	70.9 in
HEIGHT	56.5 in
PASSENGER VOLUME	96 cu ft
TRUNK VOLUME	14 cu ft
CURB WEIGHT	2967 lb

▼ C/D TEST RESULTS

ZERO TO 60 MPH	8.5 sec
ZERO TO 100 MPH	23.0 sec
ZERO TO 110 MPH	29.7 sec
ROLLING START, 5-60 MPH	8.8 sec
1/4-MILE	16.6 sec @ 87 mph
BRAKING, 70-0 MPH	166 ft
ROADHOLDING, 300-FT-DIA SKIDPAD	0.83 g
FUEL ECONOMY	
EPA CITY/HWY	28/37 mpg
C/D OBSERVED	31 mpg

■ TEST NOTES: A sewing machine if ever there were one, but that's a good thing in this class. It turns in decent braking and skidpad performances with no drama.



Elantra Limited is priced like a Sonata. Knock off the \$2500 Tech package (a big bundle, including sunroof, navigation, and premium audio) or the \$1900 Ultimate package (the aforementioned fancy stuff) if you want a small mid-sizer priced like a compact. Even so, in the \$23,185 Limited you get leather seats, 17-inch wheels, and a power driver's seat.

The back seat has good kneeroom, the trunk is commodious, and the new styling looks swift. The Elantra's a winner except for one thing: a nauseating new-car stink so intense you can taste it. Best described as plastic puke, it infects many vehicles we get from Hyundai-Kia. Well, at least it gives those guys something to fix next time.



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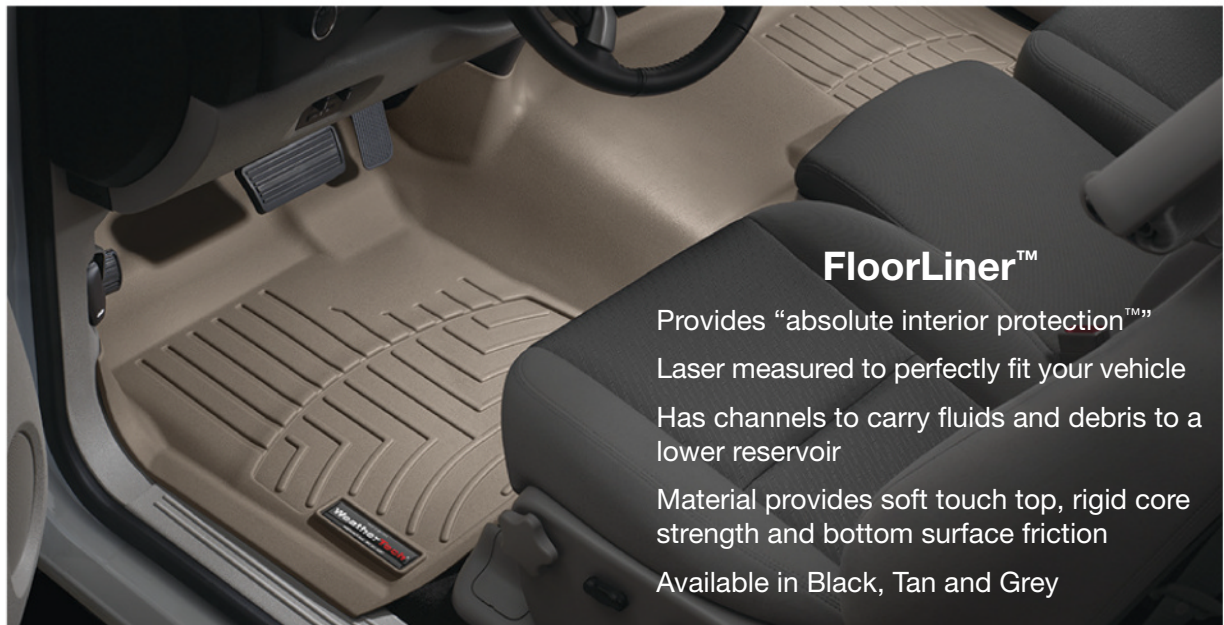


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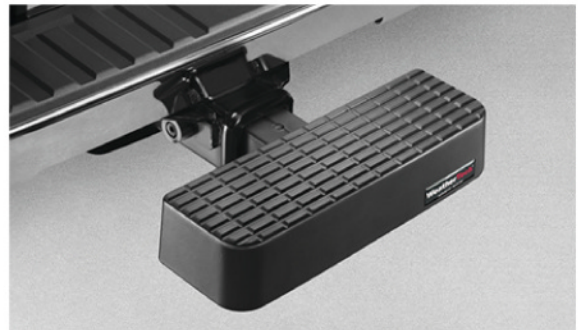
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NICK MASON

Nick Mason, 72, is Pink Floyd's drummer, loves historic racing, owns a 250GTO, and has Marino Franchitti for a son-in-law. What else do you need to know?

C/D: Your involvement with vintage racing started early?

NM: My father had a Bentley four-and-a-half liter and he would drive it to events with the family. We'd get to Silverstone, take all the weight off that we could—spare tires, headlamps—put aero screens on, and he'd go off and race it, and later we'd drive it home.

C/D: You started your own racing career in vintage cars and progressed to Le Mans. How did you get from there to there?

NM: I absolutely understand why my father didn't encourage me because it's a terrible responsibility to get your kids racing, one I've seen myself. I had a long-term idea of going racing in modern cars and then I was asked if I wanted to drive at Le Mans [in 1979]. I thought it was a bit early but I signed up. We ended up second in class and won the Index of Performance, although my Le Mans career went downhill from there horribly.

C/D: As Pink Floyd got bigger, so did your collection of historic cars. Did you ever think they would be worth serious money?

NM: I never collected cars as a financial thing; I wanted to go racing, so I chose the cars I wanted to go racing with. Like the [Ferrari 250] GTO. I bought it because it absolutely fulfilled everything I wanted from a car.

C/D: Even in the 1970s, that couldn't have been cheap.

NM: It was ludicrous, but GTOs have always been expensive. I think everyone who has bought one over the last 50 years has had to take a deep breath, it doesn't matter if you're a billionaire. It's not even a question of whether they can afford it, it's that everyone will think they are a lunatic.

C/D: An eight-figure book value must make it harder to justify using it for racing, of course.

NM: Yes, it does. Nearly everyone who is racing a really important classic car is almost certainly running a spare engine and possibly quite a lot of running gear. The other problem is that I don't really want to run the GTO at Goodwood and see it finish in 10th or 12th place because the other cars have been modified sufficiently to be three or four seconds a lap faster than they were in period.

C/D: Why does Ferrari exert such a powerful influence over musicians? Chris Rea and Eric Clapton are also aficionados.

NM: I'm not a fanatic; many of my favorite cars aren't Ferraris. My favorite of all is probably the Maserati Birdcage. Buying a Ferrari is like buying Château Pétrus if you like fine wines. It's the safe choice. I'm much more of a tart than Chris or Eric; I love the McLaren F1, that's a brilliant car, and I'm sure Eric wouldn't consider putting anything like that in his garage.

C/D: You sell cars to make space. Is it hard saying goodbye?

NM: Very hard. It's like parting with your children. Actually it's more difficult. I sold an Alfa 8C, which I should never have done, but I needed the money to pay income tax at the time. I wish now I'd gone to jail and kept the car.



C/D: Have you ever been glad to get rid of a car?

NM: If I could have, I'd have kept every damn thing I ever bought, but then I'd have at least 100 cars. The only one I was really glad to get rid of was the Indy racer, the Dayton Steel Foundry Special. I hated it, even Fangio climbed out of it and said, "I'm not driving this." And my son-in-law has a pretty good ride with Ford, so he's a bit sniffy about the Ferrari.

C/D: Is Marino Franchitti tough on the cars?

NM: No, it's not like he's a celebrity driver who turns up on a Saturday swinging his helmet. He knows the guys who look after the car and he's been involved in putting it together. It's taken us three years to give him a proper drive in the Birdcage because it just wasn't running properly.

C/D: We're trying to keep this about the cars, but will we see more Pink Floyd material?

NM: There's still quite a lot of work to do with what I call gardening. We've got the 50th anniversary next year. I'd love there to be some new stuff, but I don't think it's very likely. The problem now with changes in the music industry is that there's almost no point in making records anymore. The only thing really is to tour, and then you're revisiting history. Maybe it's better to leave it, if you see what I mean. I think we managed to stay fairly true to what we believed in.

C/D: What would you do differently?

NM: Not much, but buy more cars, sell fewer, take drum lessons. I would like to have been a better technical drummer. But for the rest of it, not much. Not much at all. —MIKE DUFF

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